General Anatomy

Lecture 14: Cardiovascular System (1)

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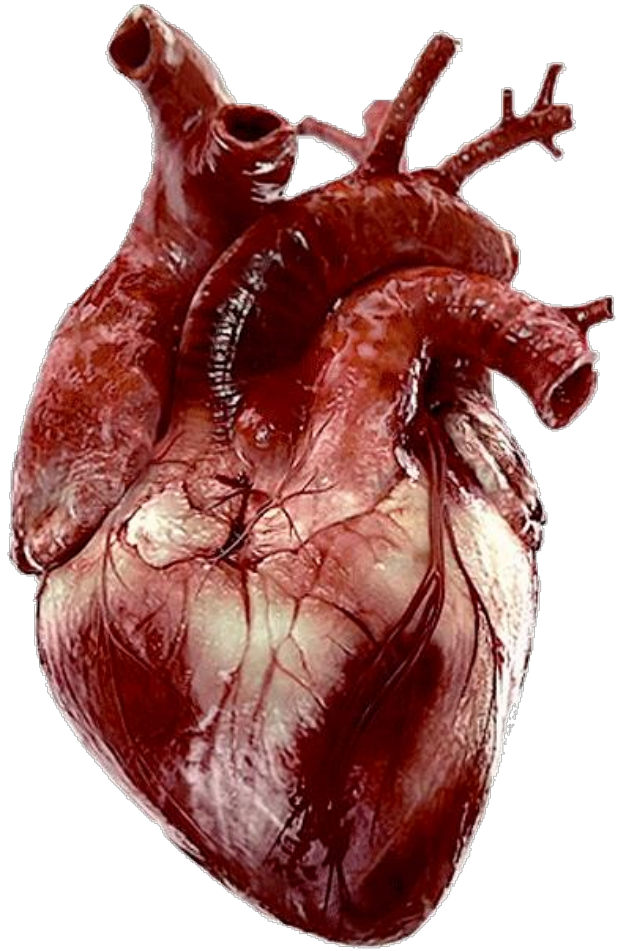
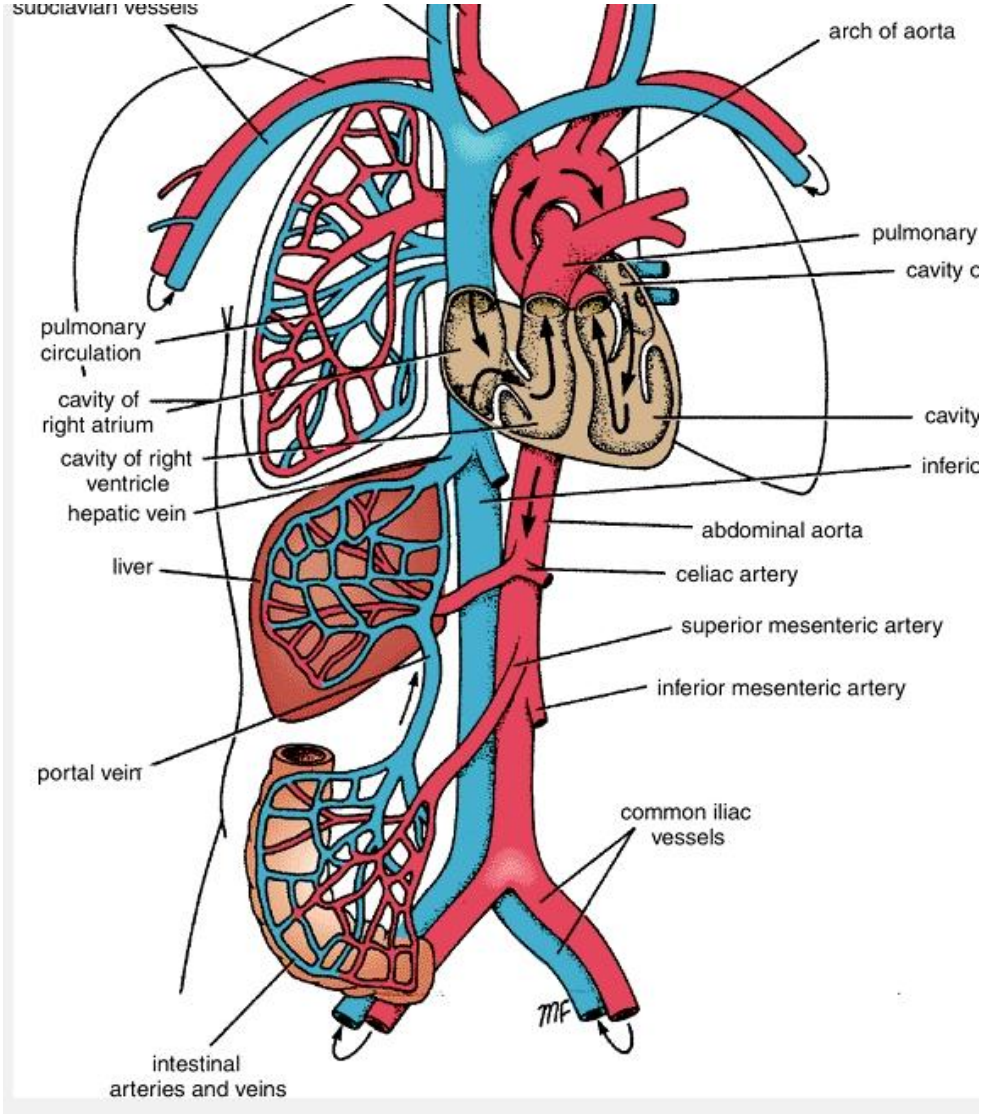


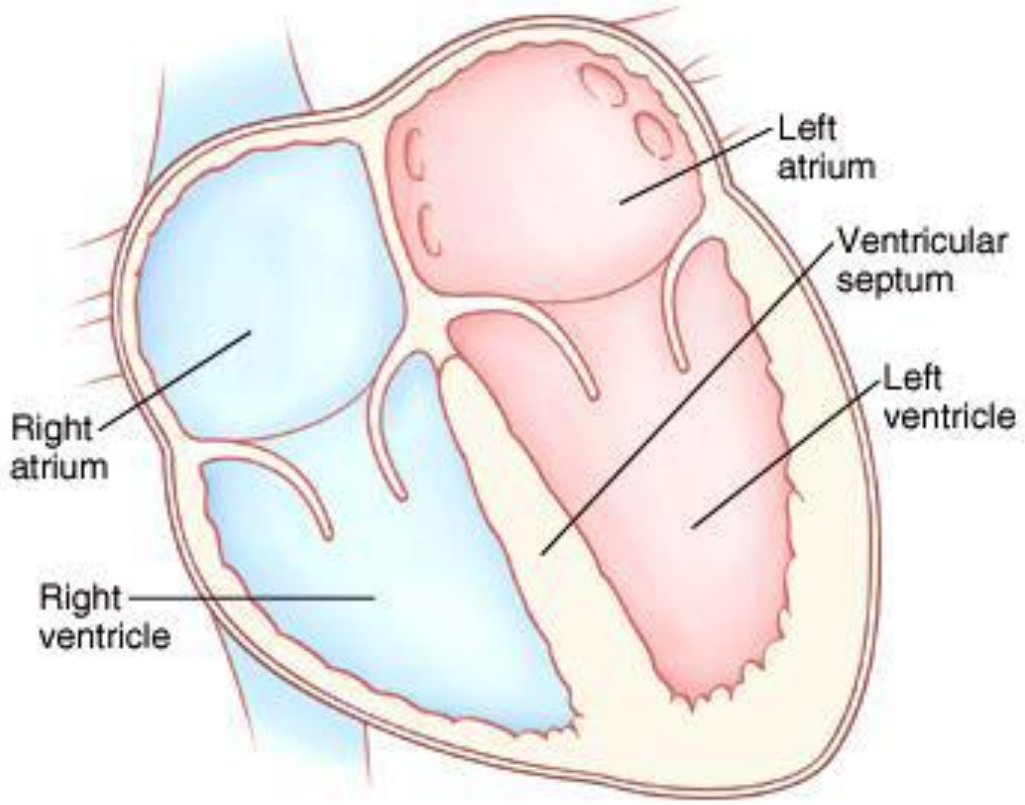
THE CARDIOVASCULAR SYSTEM

* **Definition:**
* **It is the major part of the circulatory system.**
* **It consists of 2 main parts:**
  1. **heart.**
  2. **Blood vessels.**



THE HEART

* **Definition:** A conical hollow muscular organ that pumps the blood to various parts of the body.
* **Site:** In the middle mediastinum (middle space of thoracic cavity).
* **Weight:** 300 gm in males & 250 gm in females.
* **Dimensions:** 12X9 cm.



** **Pericardium:** The heart is surrounded by the pericardium, which is divided into:

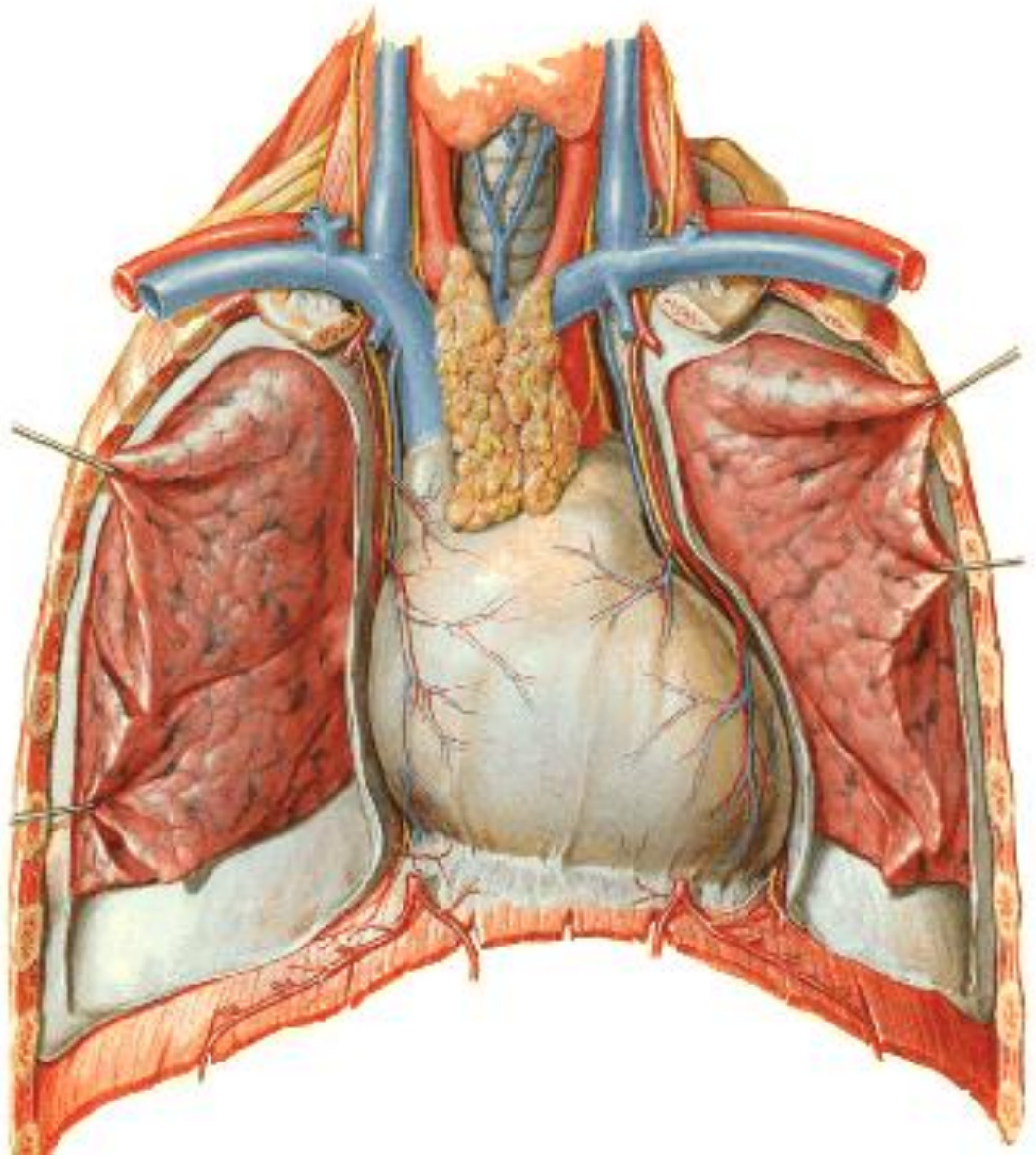
a. **outer fibrous pericardium:** thick, fibrous & attached to diaphragm.

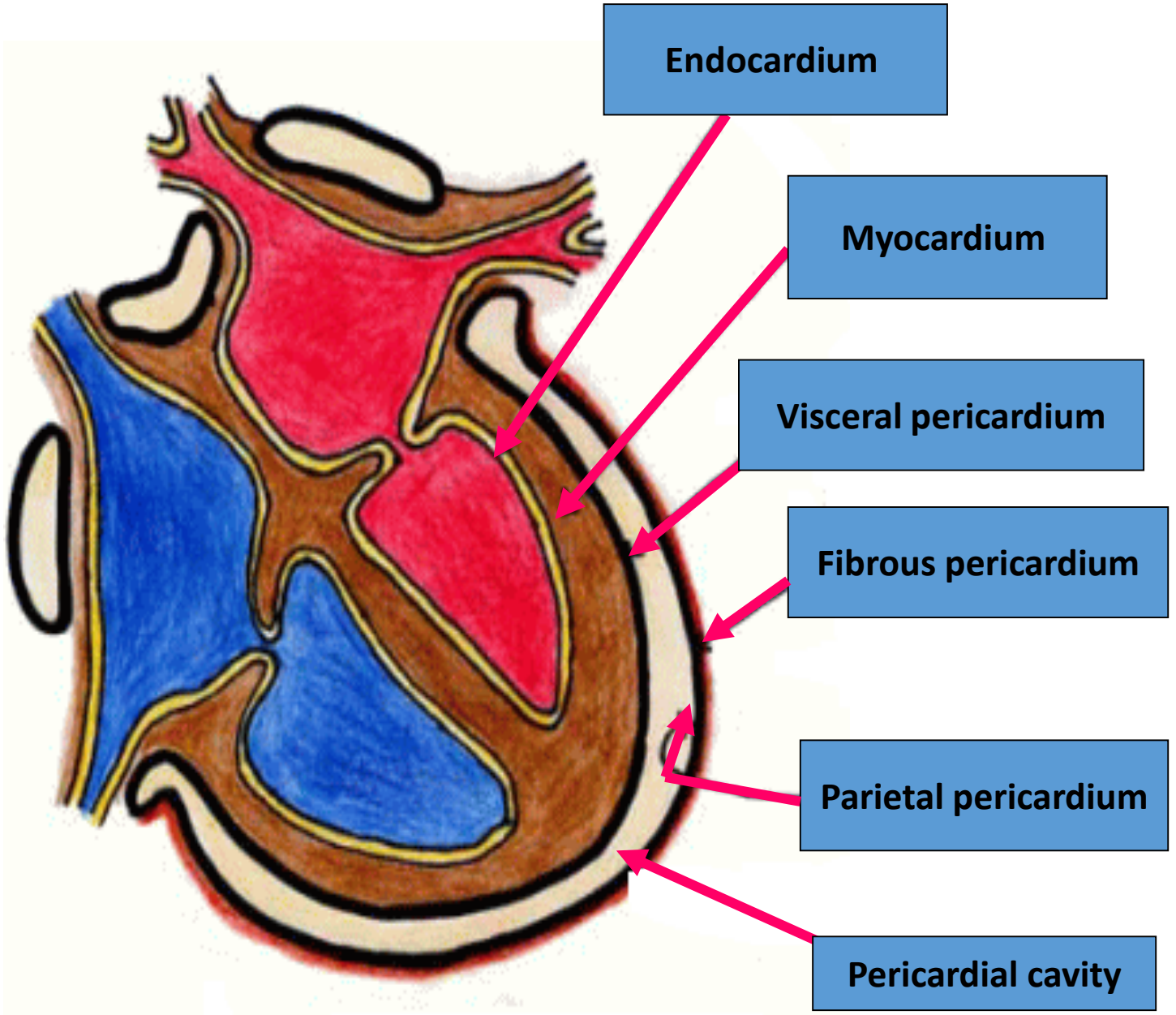
b. **inner serous pericardium:** which consists of 2 layers:

i. **outer parietal:** lines the fibrous pericardium.

ii. **inner visceral:** covers the heart.

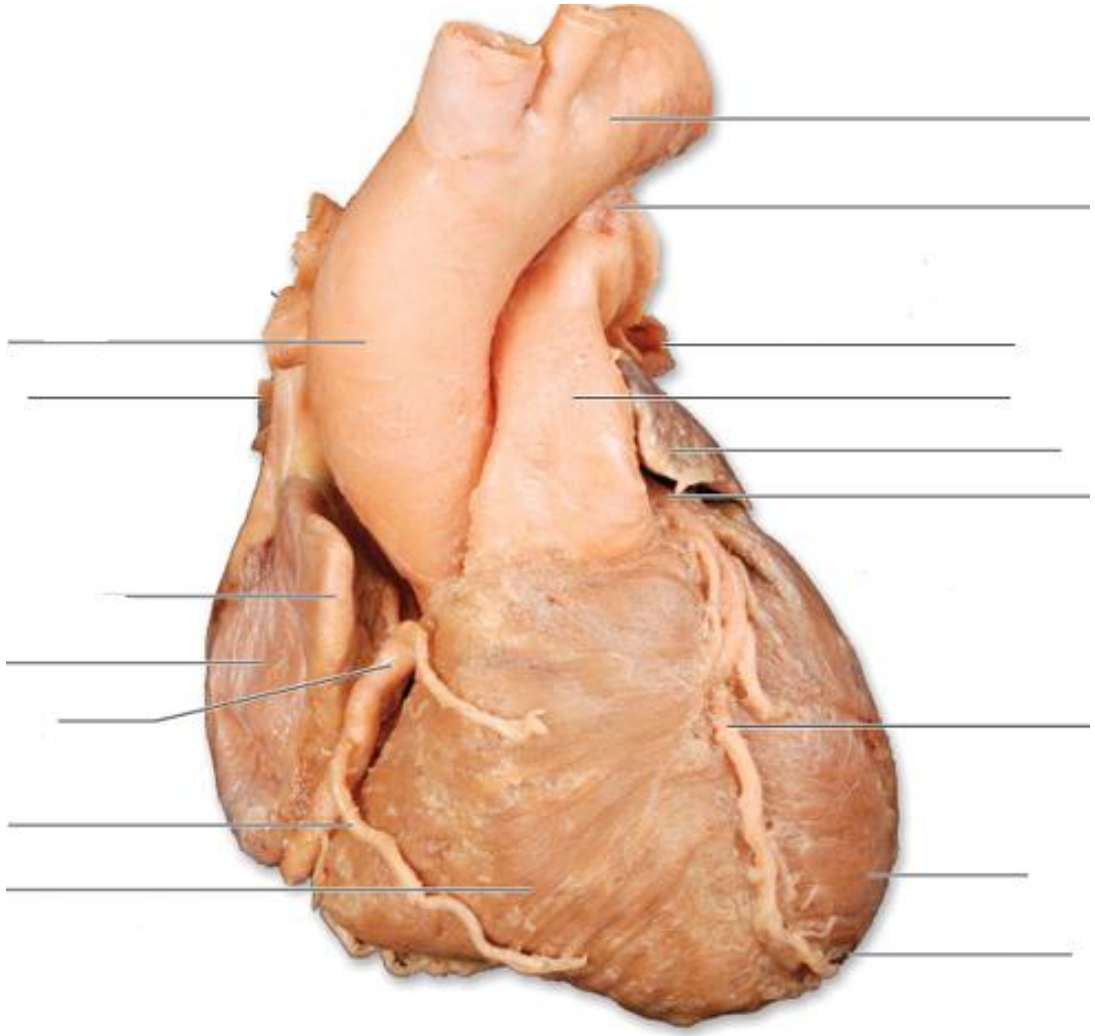
** The space between the 2 layers is called the pericardial cavity.




Endocardium
Myocardium
Visceral pericardium
Fibrous pericardium
Parietal pericardium
Pericardial cavity

** External features of the heart: it has:

1. Apex.
2. Base.
3. Four borders.
4. Two surfaces
5. Four chambers.



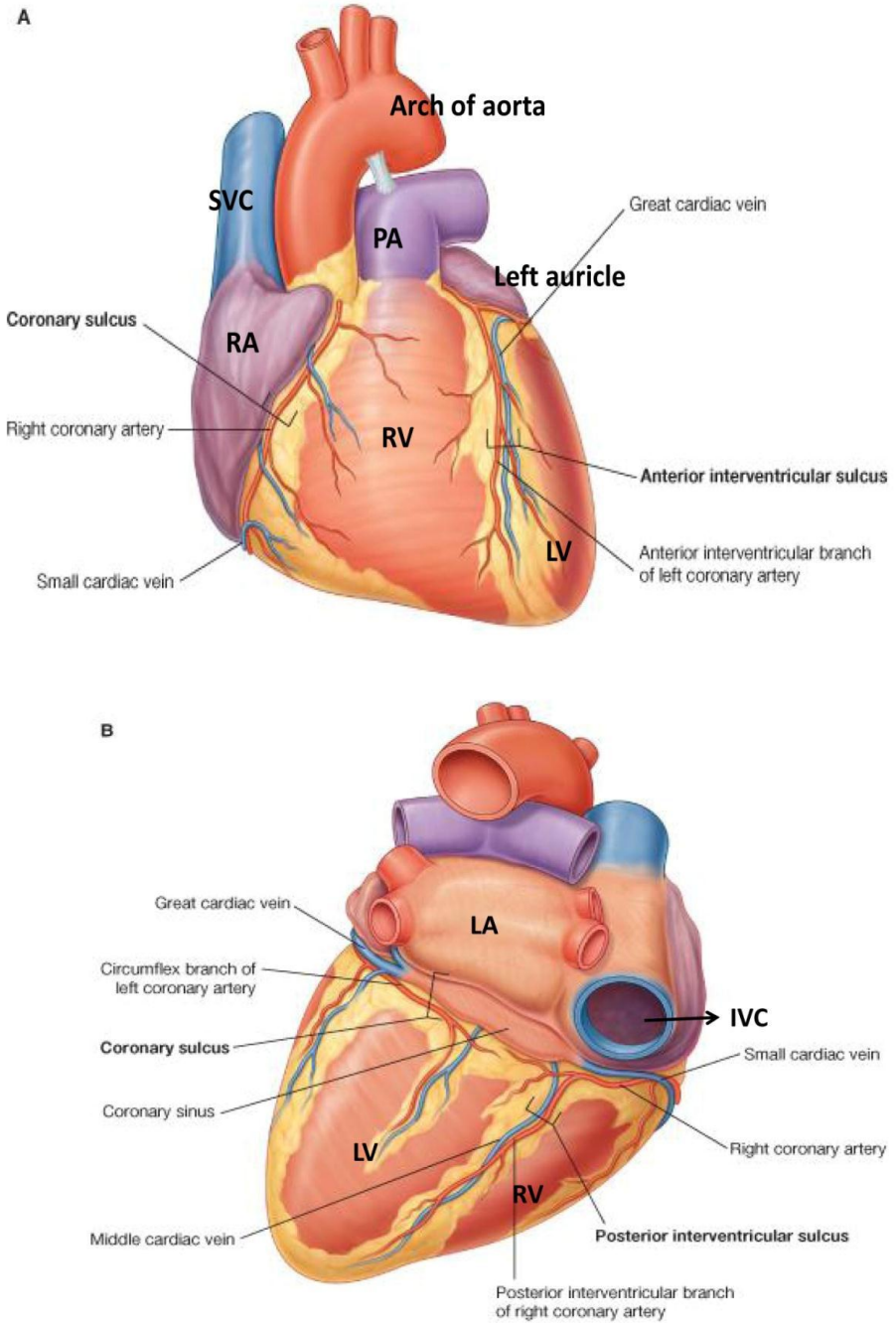
(a) Anterior view

1. The apex of the heart:

* Formed of the Lt ventricle & directed downward forward to the left.
* It lies in the 5th left intercostal space, 9.5 cm from the mid-sternal line.

2. The base of the heart:

* Formed of both atria, mainly the left atrium & directed backward, upward & to the right, forming the posterior aspect of the heart.



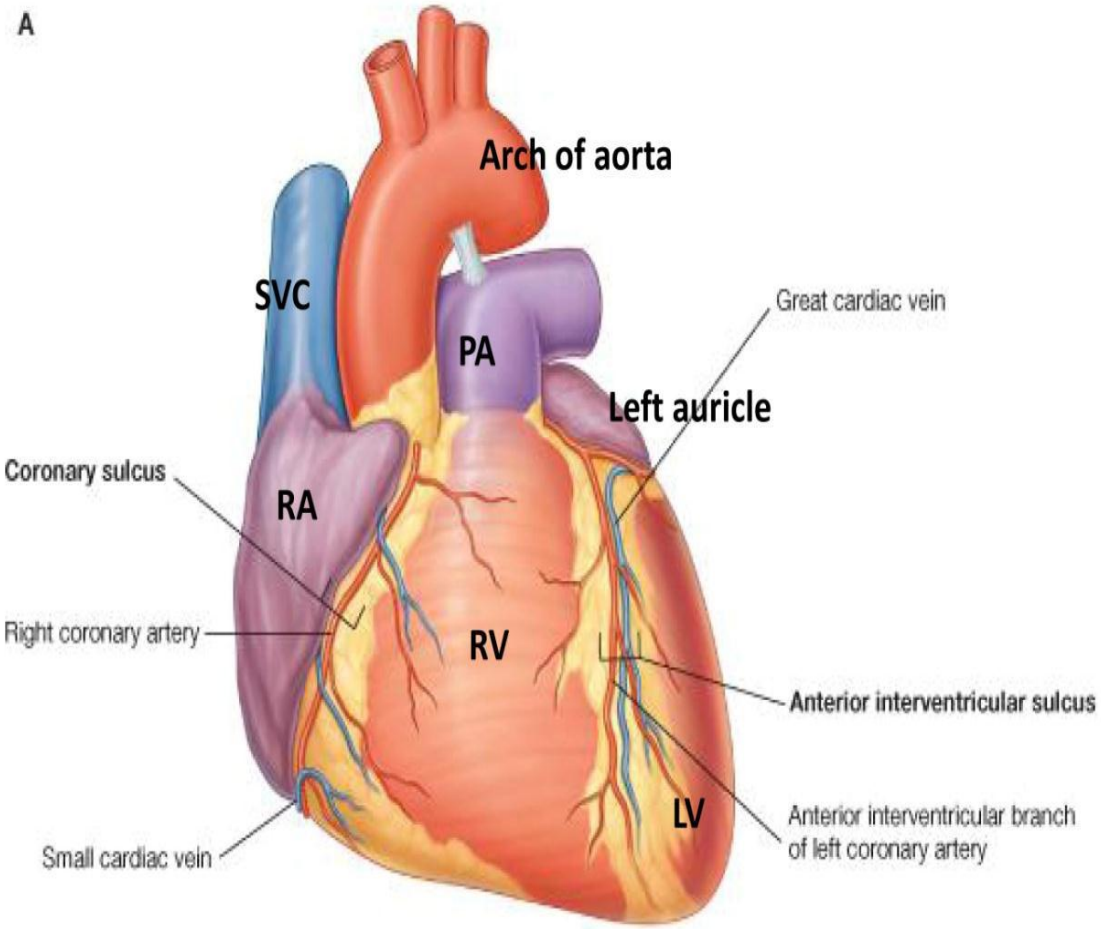
3. The borders of the heart are:

a. Upper border formed by the 2 atria.

b. Lower border formed by the 2 ventricles.

c. Right border formed by the right atrium.

d. Left border formed by the left ventricle & left auricle.



4. The surfaces of the heart:

* It has 2 surfaces:

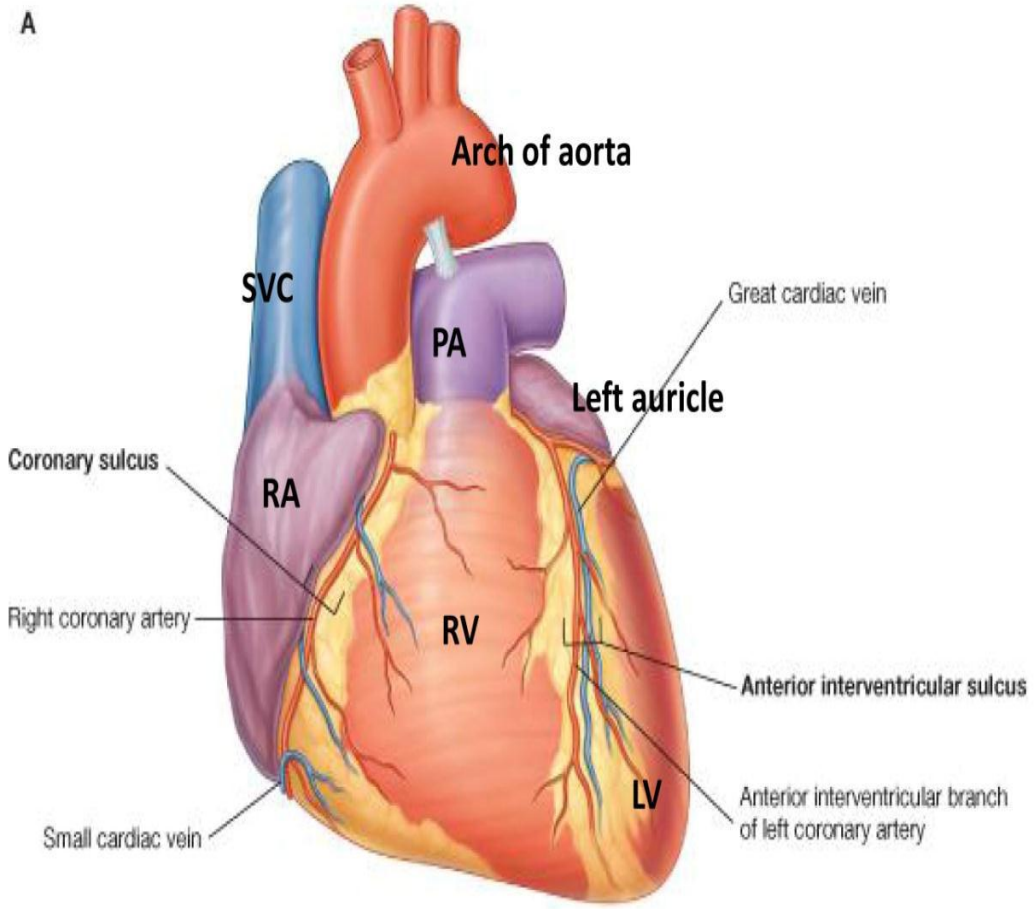
a. Anterior or sternocostal surface: is divided by coronary sulcus into:

1. Atrial part formed mainly by RT atrium.

2. Ventricular part: subdivided by anterior interventricular sulcus into:

* RT 2/3 formed by RT ventricle.

* LT 1/3 formed by LT ventricle.

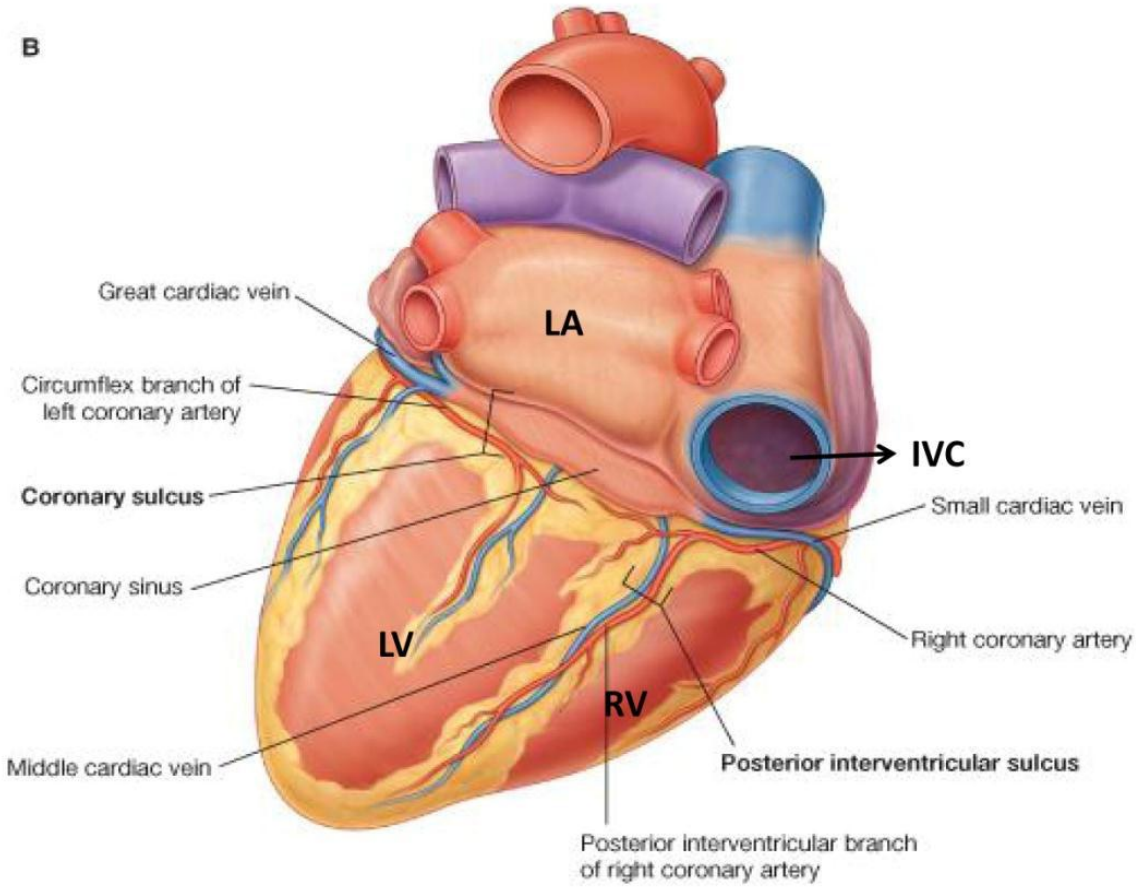


b. Inferior or diaphragmatic surface:

* Formed by the 2 ventricles & divided by posterior interventricular sulcus into:

* LT 2/3 formed by LT ventricle.

* RT 1/3 formed by the RT ventricle.

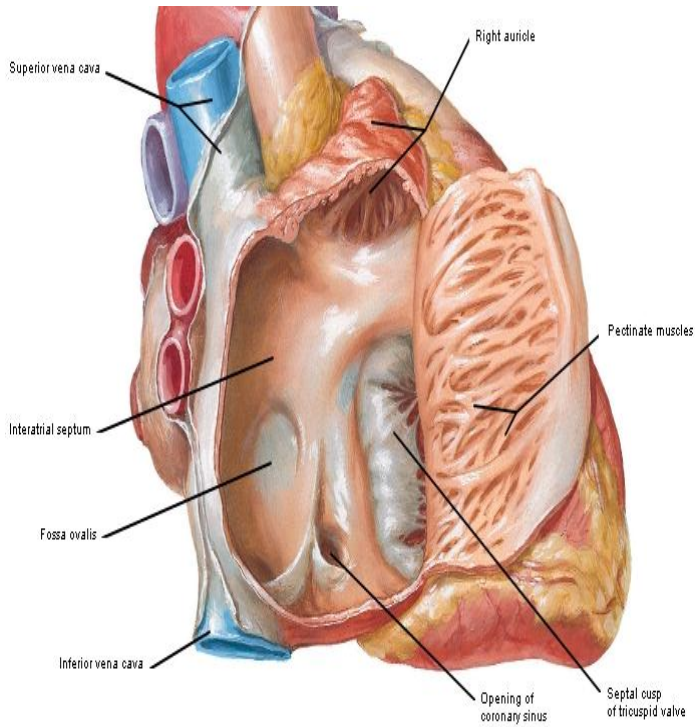


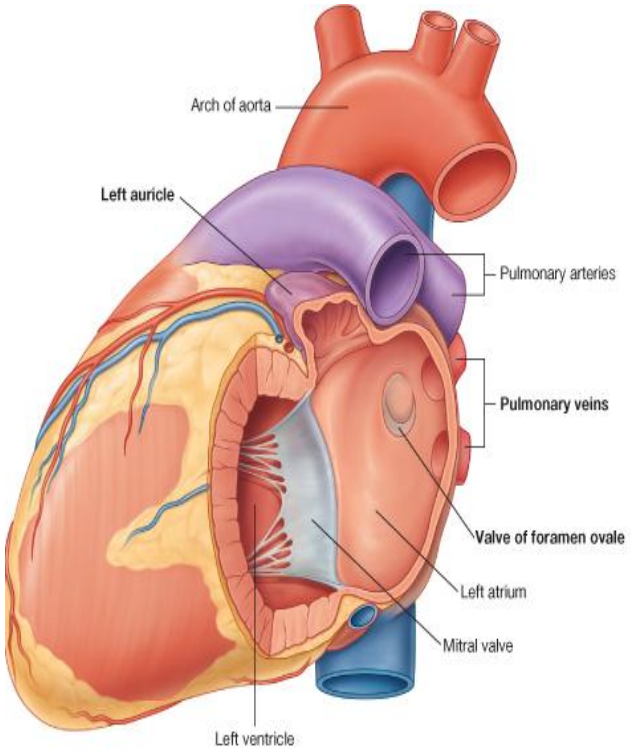
5. The chambers of the heart:

a. The RT atrium: has 2 walls:

* Anterior rough or muscular.
* Posterior smooth receiving the openings of big veins SVC, IVC& Coronary sinus.

b. The LT atrium: its wall is mostly smooth, receiving the openings of the 4 pulmonary veins.

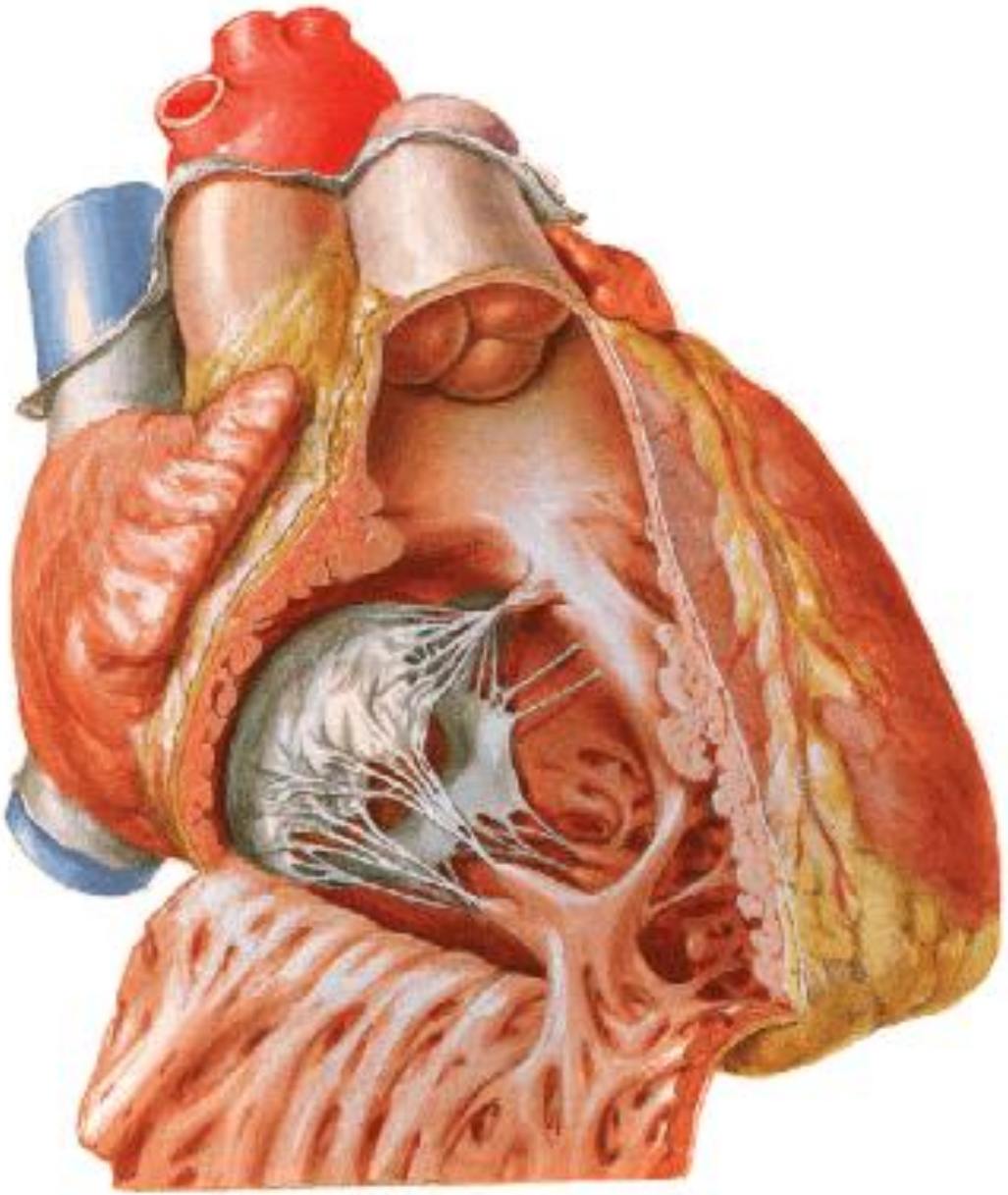




c. The RT ventricle: is divided into 2 parts:

1. Rough muscular inflowing part: receives the blood from the right atrium & contains 3 papillary muscles.

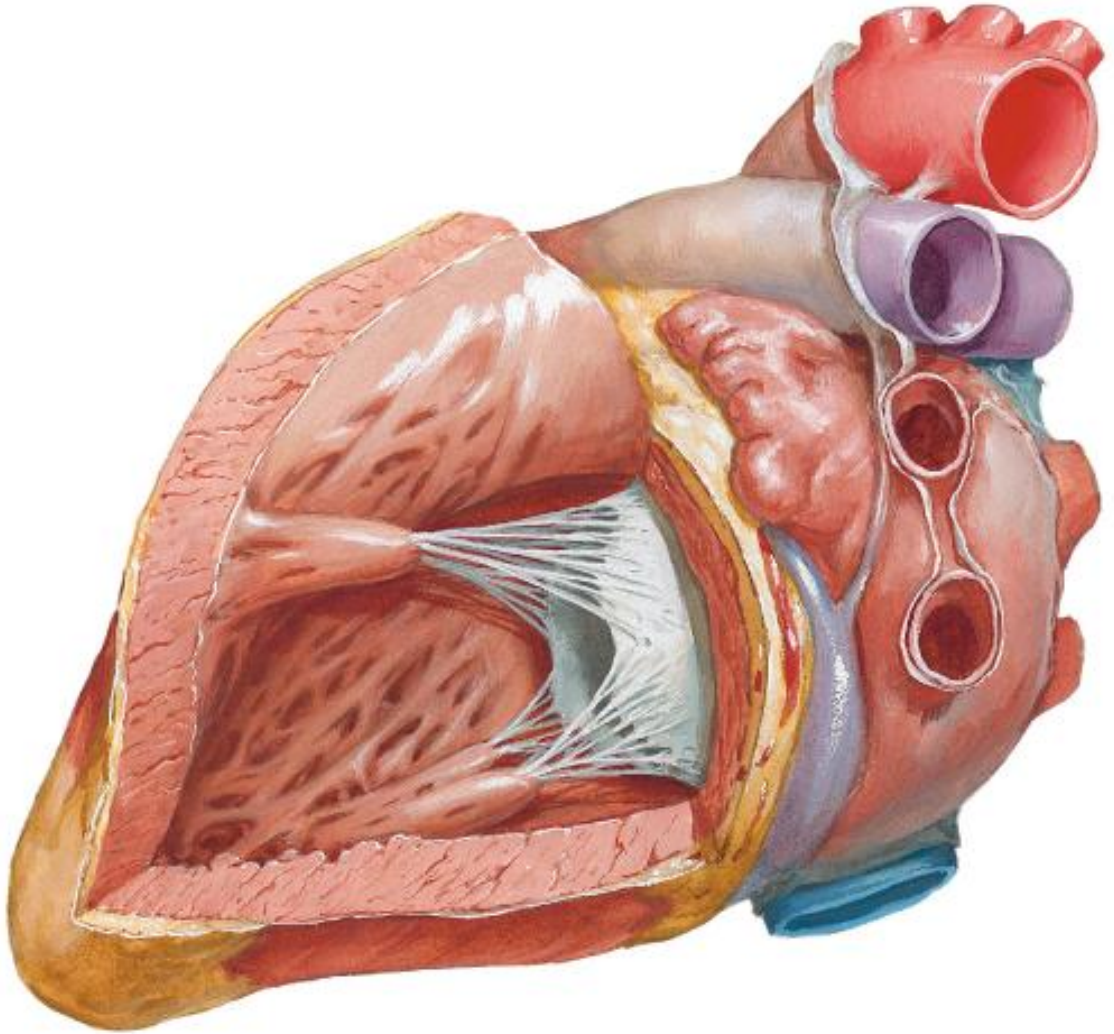
2. Smooth outflowing part: It is called Infundibulum: it pushes the blood into the pulmonary trunk.



d. LT ventricle: is divided into 2 parts:

1. Rough muscular inflowing part: receives the blood from the left atrium & contains 2 papillary muscles.

2. Smooth outflowing part: It is called vestibule: it pushes the blood into the aorta.

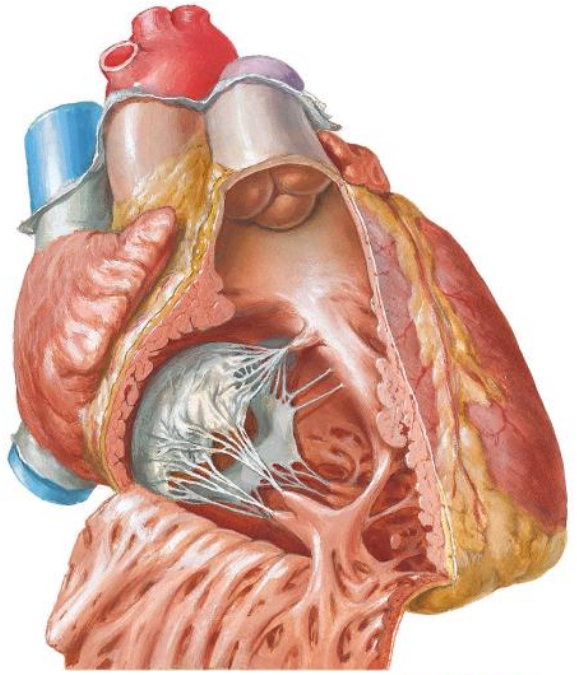


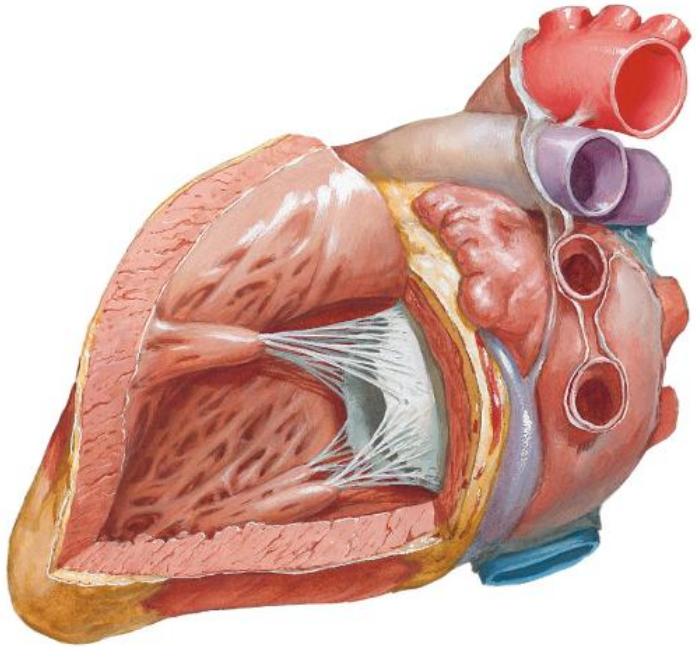
** The valves of the heart:

There are 2 types of heart valves:

a. Atrio-ventricular (AV) valves:

1. The right valve called Tricuspid. It has 3 cusps separating the right atrium from right ventricle.
2. The left valve called Bicusped or Mitral. It has 2 cusps separating the left atrium from left ventricle.

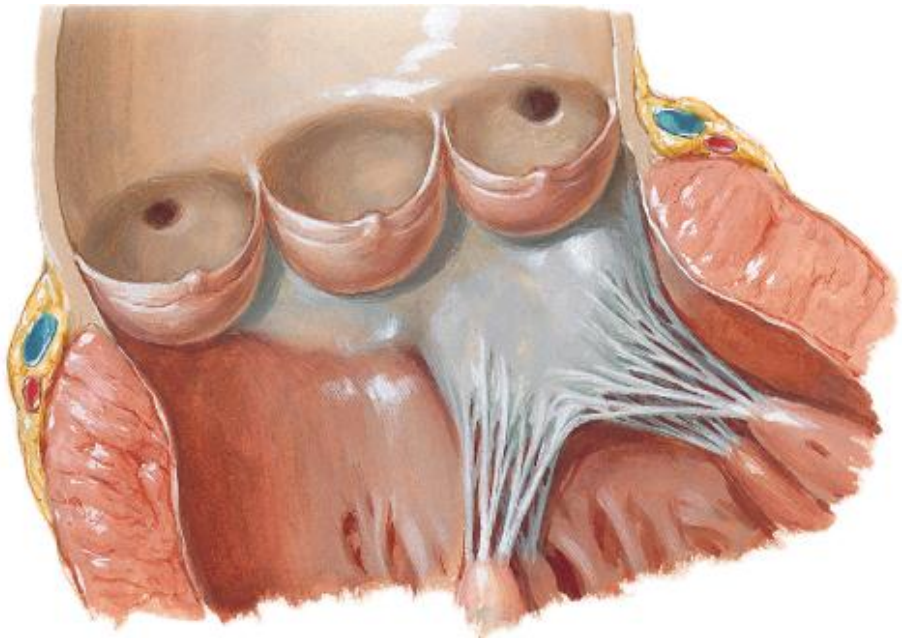




b. Semilunar valves:

They are formed of 3 cusps, each cusp has a hollow space above called sinus.

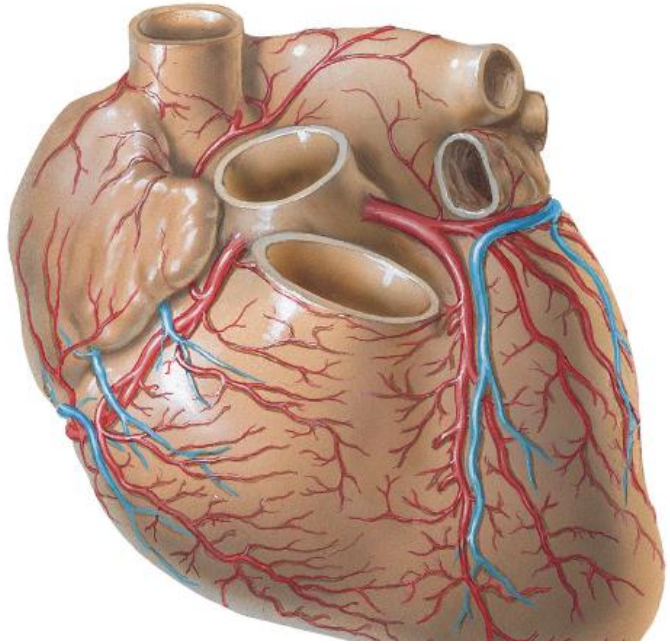
1. Aortic valve: has one sinus anterior & 2 sinuses posterior.
2. Pulmonary valve: has one sinus posterior & 2 sinuses anterior.

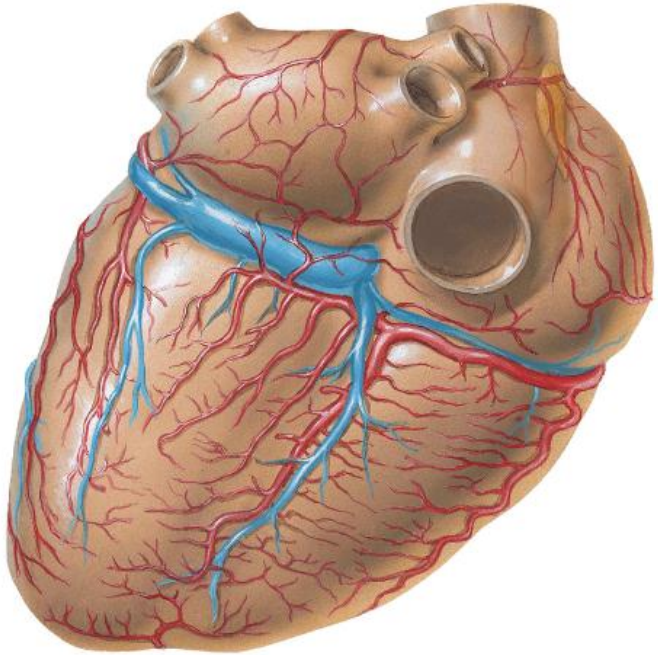


**Blood supply of heart:

1. Arterial supply: by the coronary arteries (RT&LT) that arise from the beginning of ascending aorta.

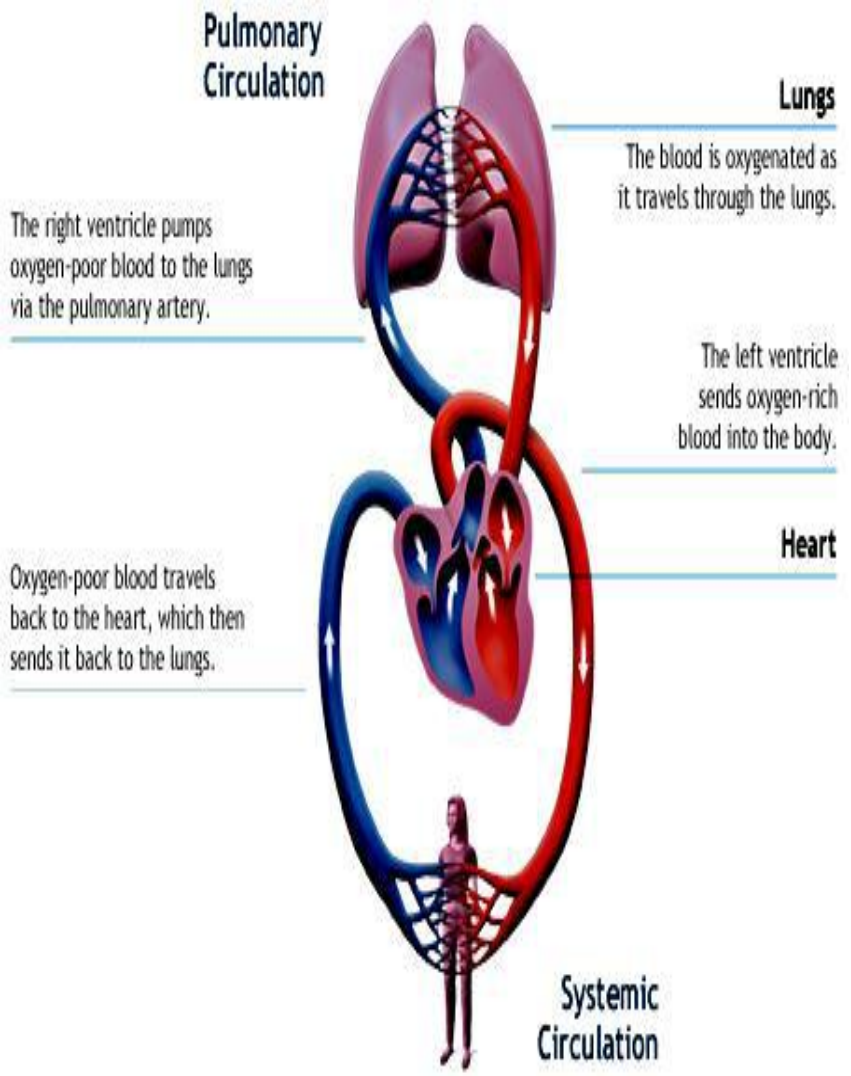
2. Venous drainage: through small veins that end in short venous channel called coronary sinus that opens in the RT atrium.



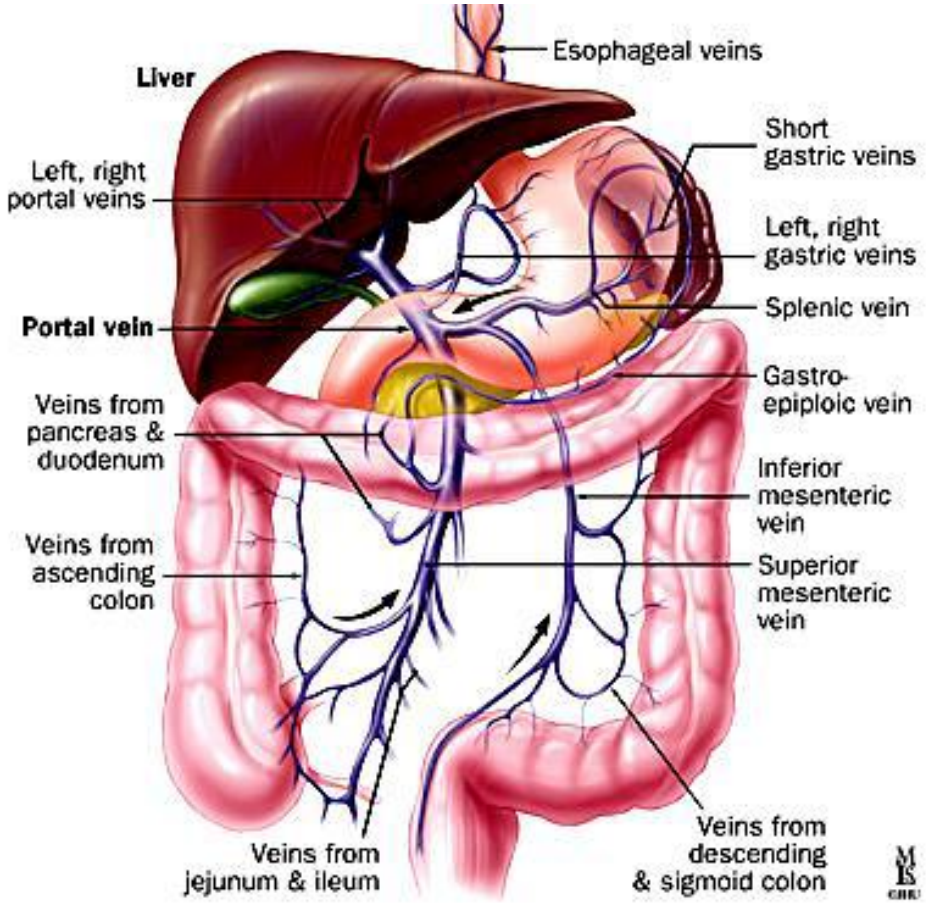


Types of Blood Circulations

1. **Systemic circulation: It is the passage of blood from the Lt ventricle to the whole body via the aorta & its branches then returning the blood back to the Rt atrium through the SVC & IVC.**
2. **Pulmonary circulation: It is the passage of the non-oxygenated blood from the Rt ventricle to the lungs via the pulmonary arteries then returning the blood back to the Lt atrium through the pulmonary veins after oxygenation.**



3. Portal circulation: It is the passage of the venous blood from the gastrointestinal system carrying the products of digestion & absorption to the liver via the portal vein where the liver cells metabolize these products, then returning back the blood to the systemic circulation through the hepatic veins to the IVC to the right atrium.



General Anatomy

Lecture 15: Cardiovascular System (2)

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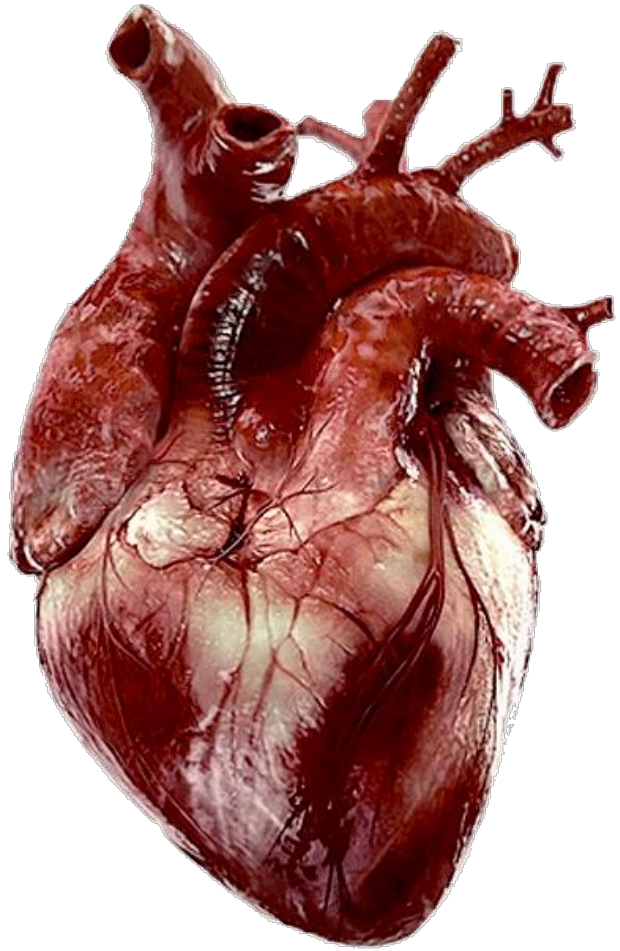
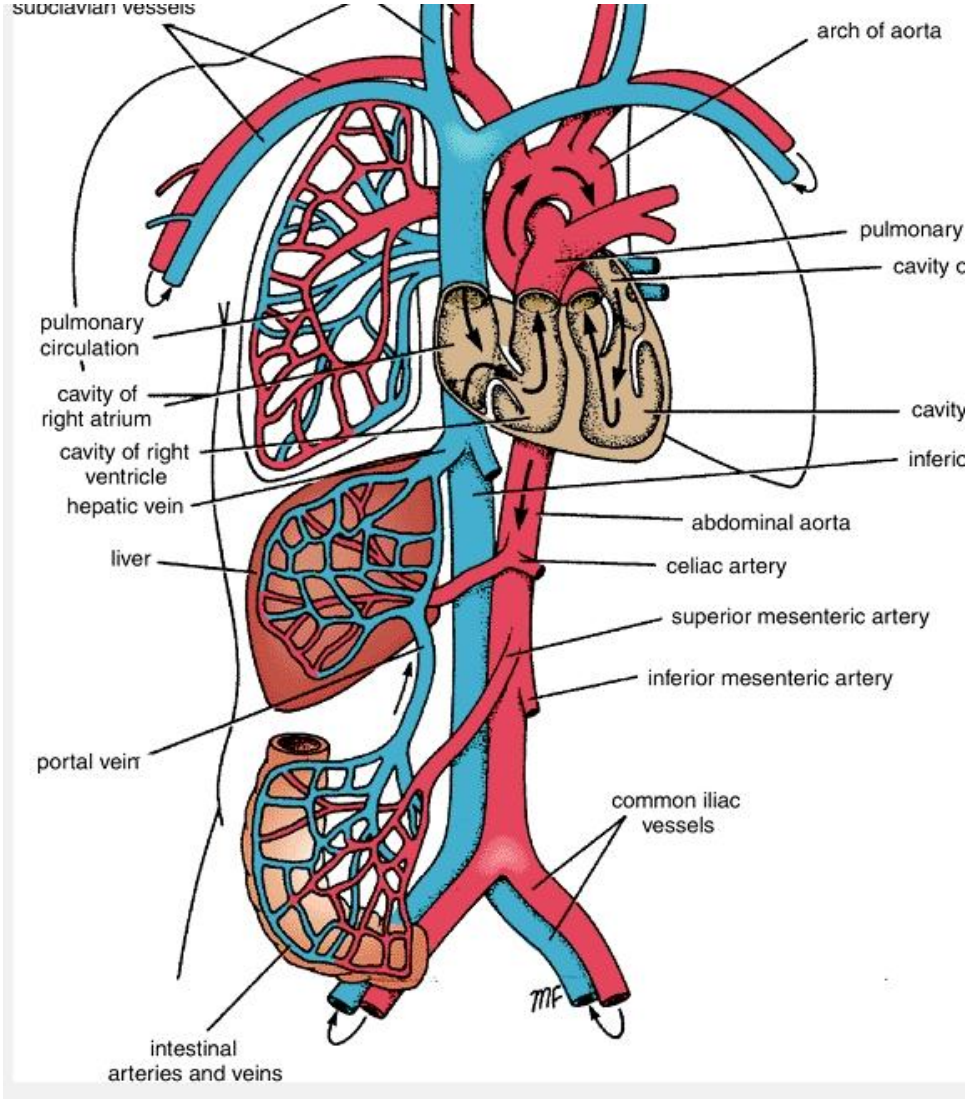


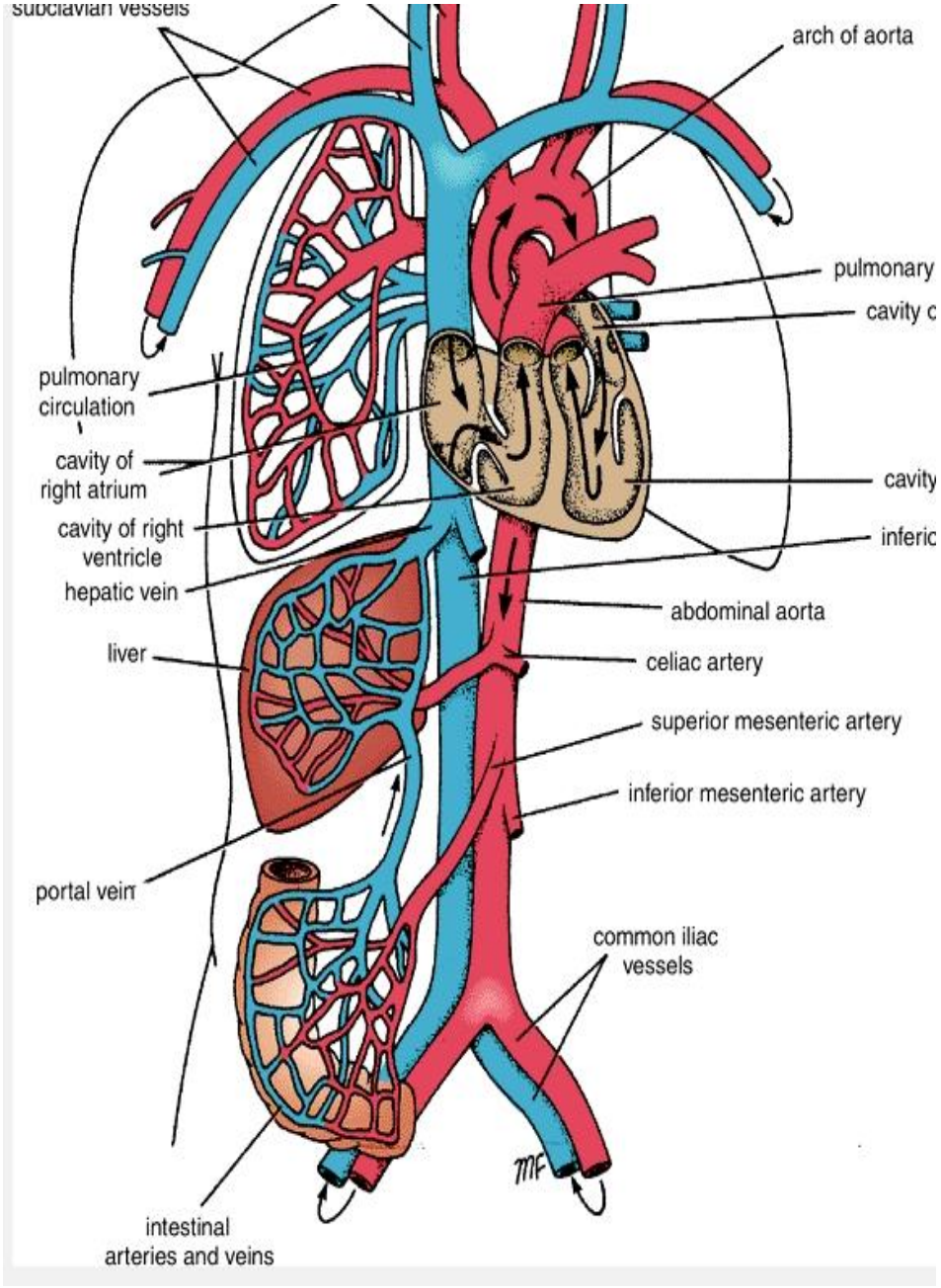
BLOOD VESSELS

** Types of blood vessels:

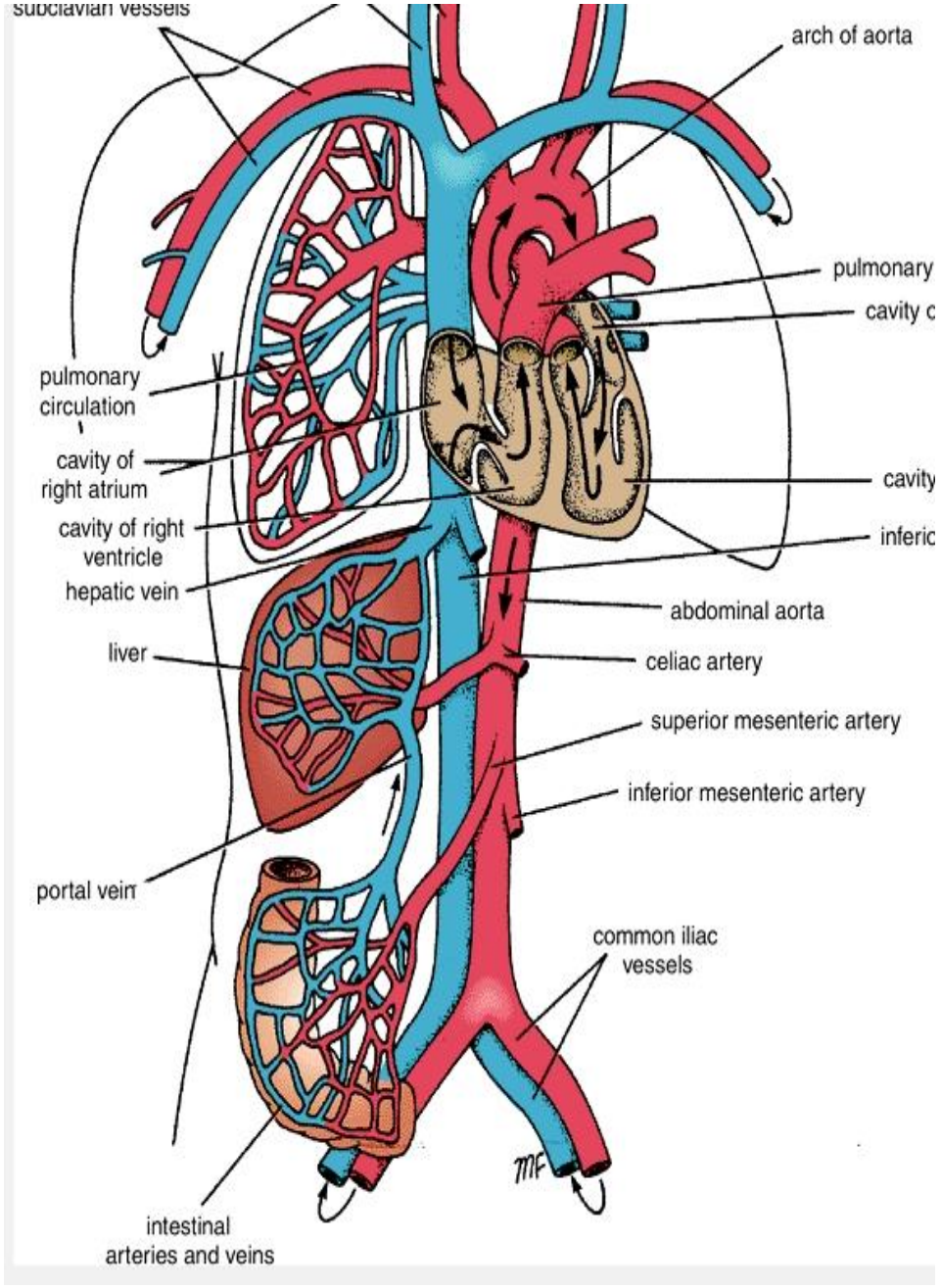
1. Arteries.
2. veins.
3. Capillaries.



- The blood leaves the left ventricle of the heart through the aorta, which divides into smaller branches to supply the different systems & tissues of the body.
- These branches divide into smaller & smaller arteries till they end inside tissues by giving small arterioles. These arterioles divide into smaller arterioles & finally, the smaller ones join the capillaries.



* Capillaries collect into very minute venules, which collect into small veins. These veins unite to form large veins, which collect into larger veins, & finally, veins collect in 2 big veins; Superior vena cava (SVC) & inferior vena cava (IVC), which open into the right atrium of the heart.



Arteries	Veins
1. Carry blood away from the heart.	1. Carry blood towards the heart.
2. Carry oxygenated bl. (except Pulmonary A.)	2. Carry deoxygenated bl. (except Pulmonary V.)
3. Divide into branches.	3 Collect from tributaries.
4. Its wall is rich in smooth ms. & elastic fibers (Non-compressible).	4. Its wall is poor in its smooth muscle & elastic fibers (compressible).
5. Thick-walled & narrow lumen.	5. Thin-walled & wide lumen.
6. Do not contain valves.	6. Contain valves.

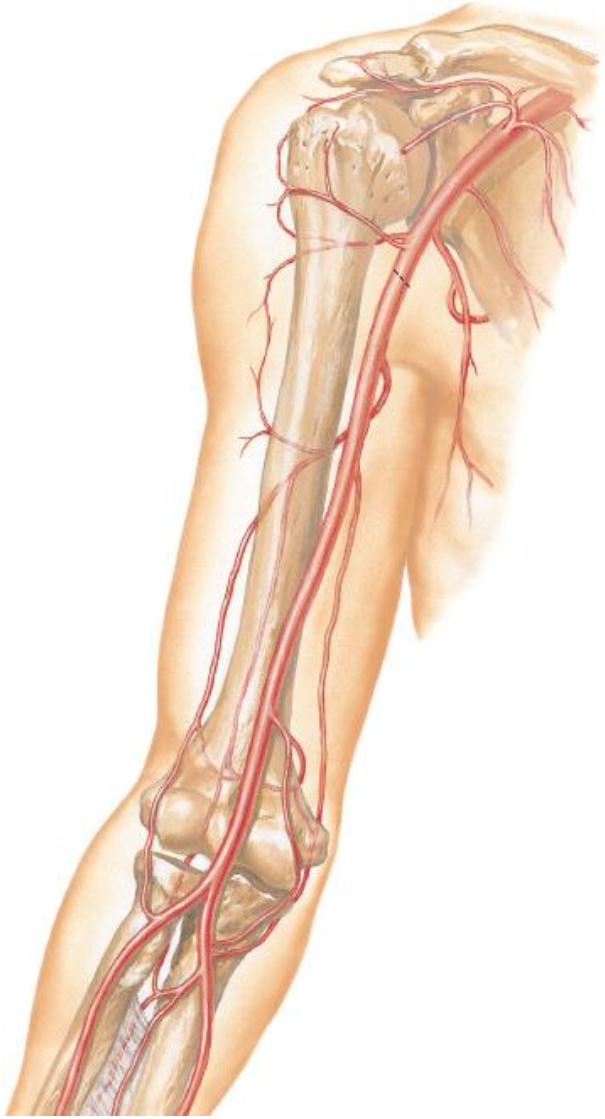
Arterial Anastomosis

* This is a connection between branches of one artery & branches of adjacent artery.

* It allows a **collateral circulation** in case of obstruction of one of the 2 arteries.

* It is present mainly around joints.

* Arteries which do not anastomose are called **end arteries**.

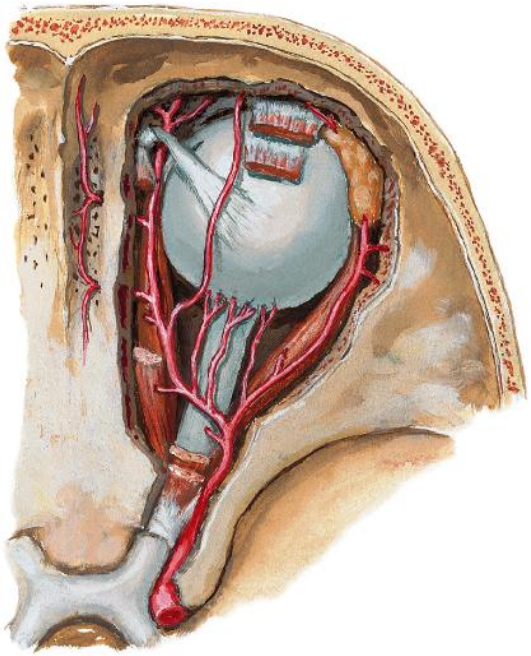


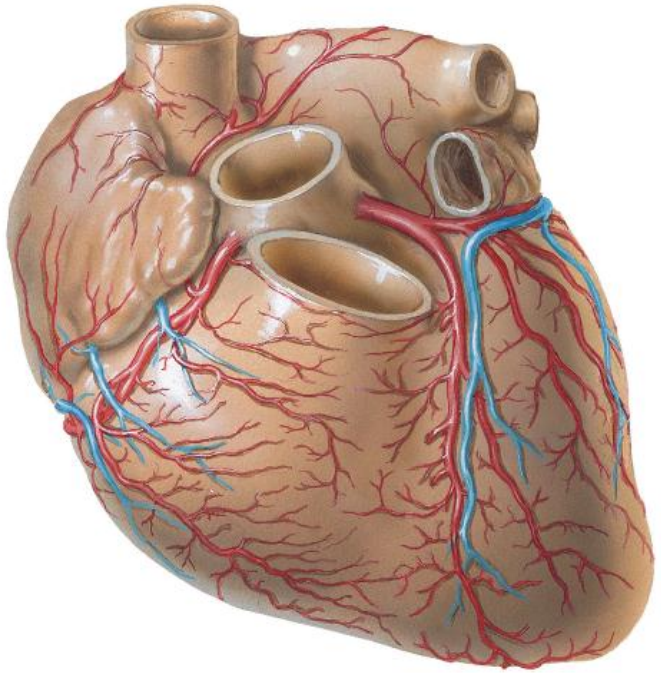
End Arteries

* **Are of 2 types:**

1. Anatomical end arteries: which do not acquire any sort of anastomosis **e.g. central retinal artery.**

2. Functional end arteries: which have some anastomosis between its arteries, however, it is insufficient to compensate the obstructed artery, **e.g. coronary arteries of the heart.**





Types of anastomosis between arteries & veins

A. Capillaries: Small vascular connections present in all body organs connecting the small arterioles to the small venules.

B. Direct arterio-venous Shunt:

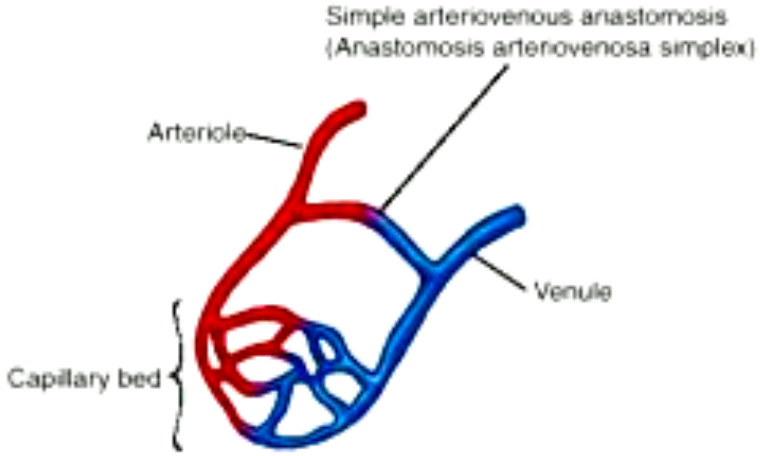
* This is a **direct shunt** between arteries &veins in the tissues.

* **It is present in certain areas**, such as in palm of hand, sole of foot, auricle, nose, lips & gastro-intestinal tract.

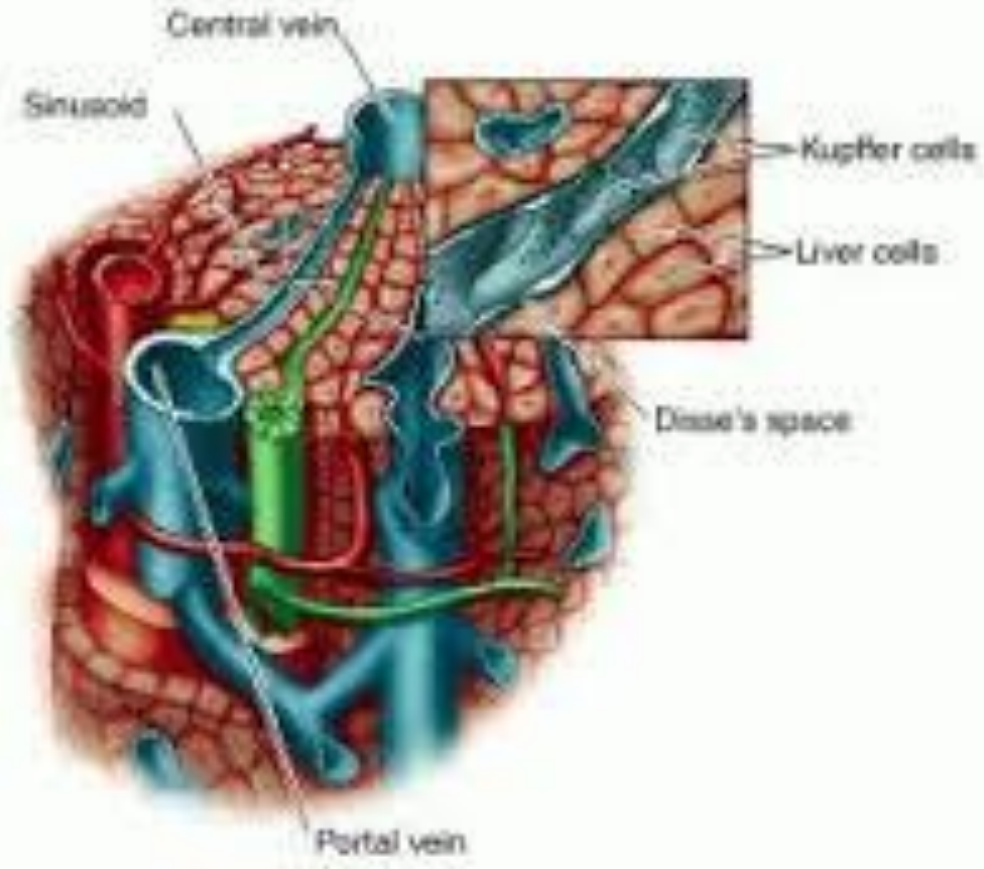
* **It plays an important role in**:

1. **Regulation of the blood flow** to each organ.

2. **Regulation of body temperature** (since it can help losing temperature in some cases or storing temperature in other cases).



C. Sinusoids: are wide tortuous vascular spaces lined with phagocytes, present in liver, spleen & bone marrow. They slow down blood flow allowing maximum exchange of O_2, CO_2 & nutrients between blood & tissues.



D. Cavernous (erectile) tissue: Small vascular spaces filled with blood, present in the erectile tissues of penis & clitoris.

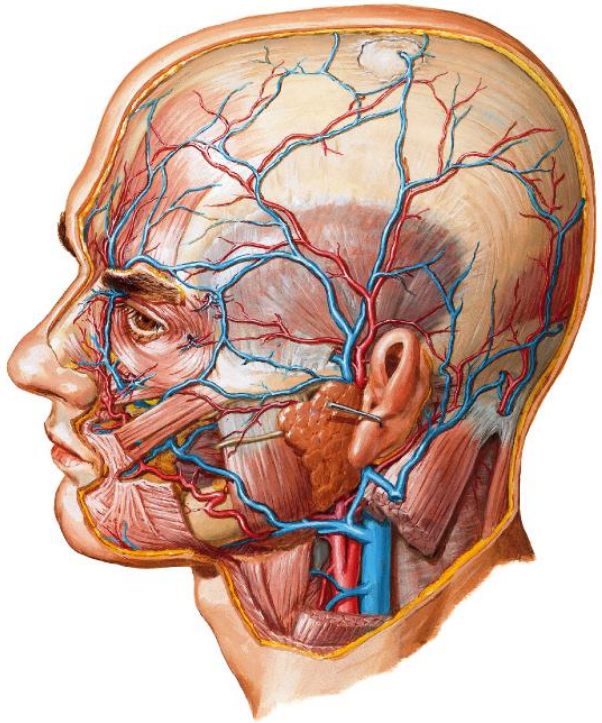
Tortuous arteries

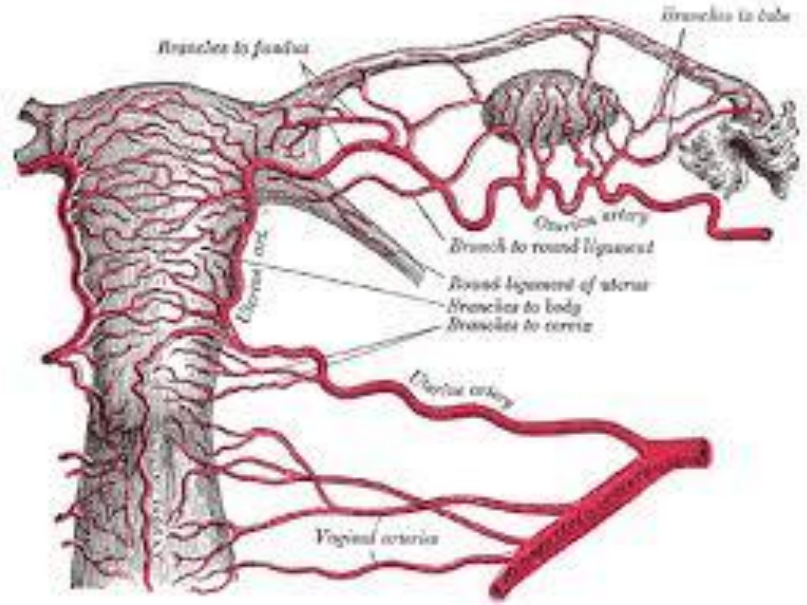
* Are irregular arteries & are present in:

a. **Movable organ**; as facial A.

b. **Expansile organ**; as arteries of uterus &urinary bladder.

c. **Protrudable organ**; as lingual A.



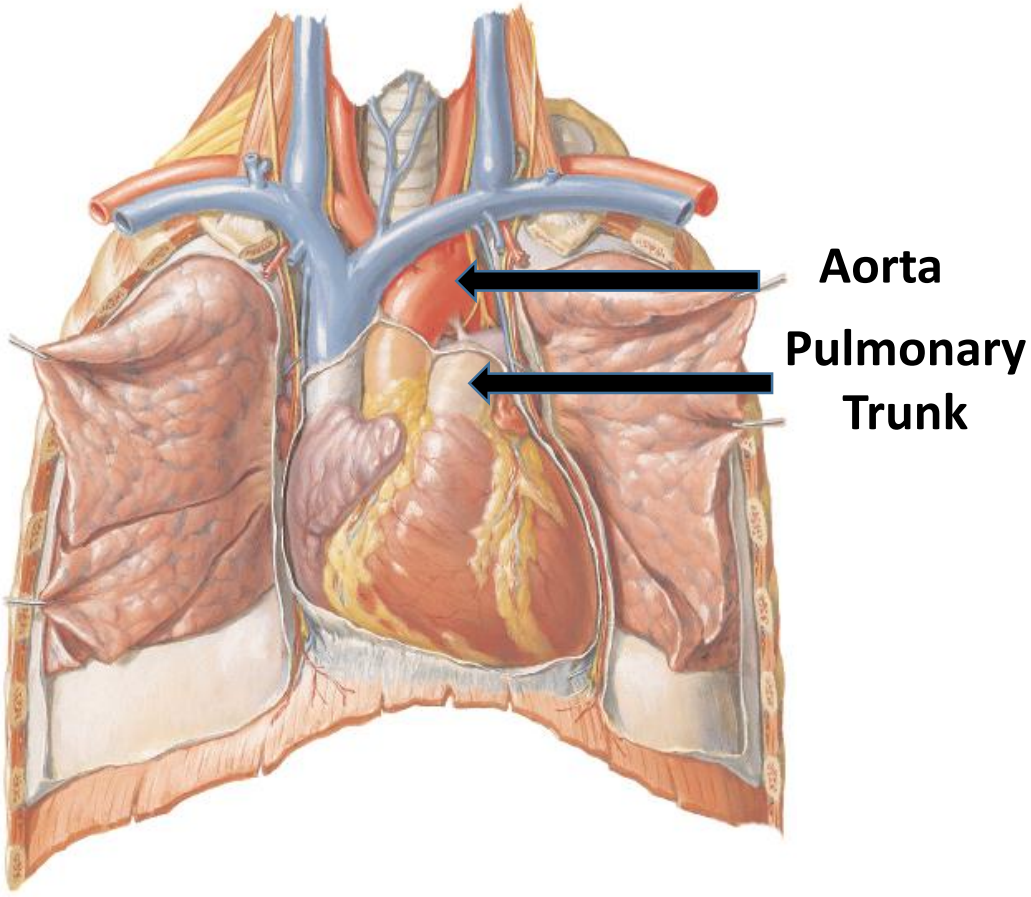


Main Arteries of the Body

*** Important arteries originating from heart:**

I. Pulmonary Trunk: arises from right ventricle carrying deoxygenated blood to lungs.

II. Aorta: arises from left ventricle carrying oxygenated blood to be distributed to all systems of body.



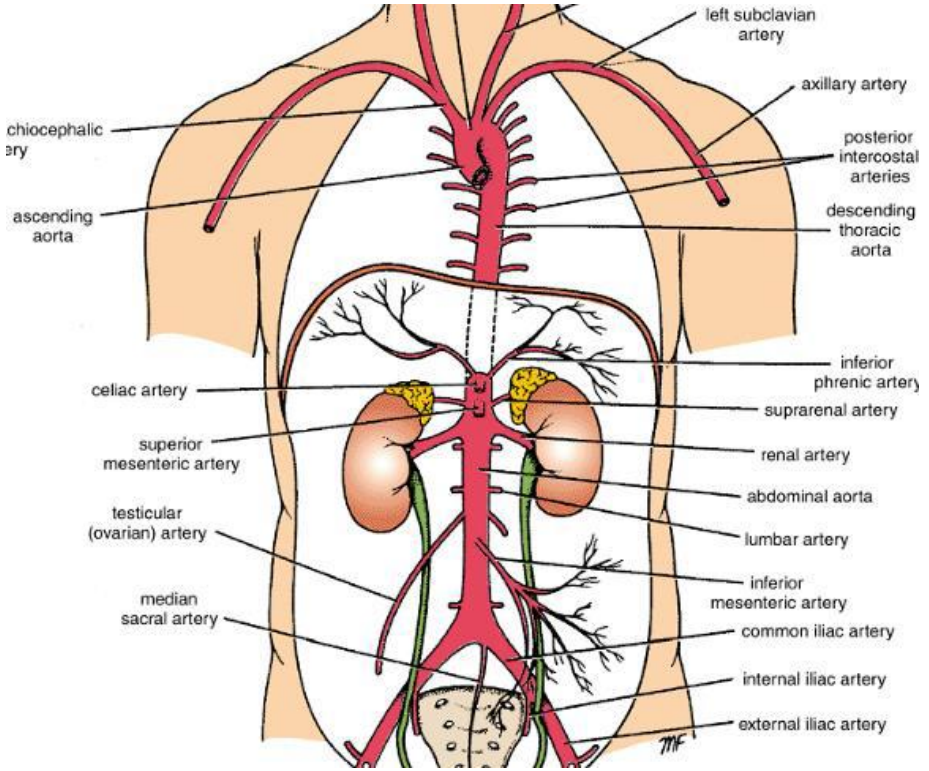
The AORTA

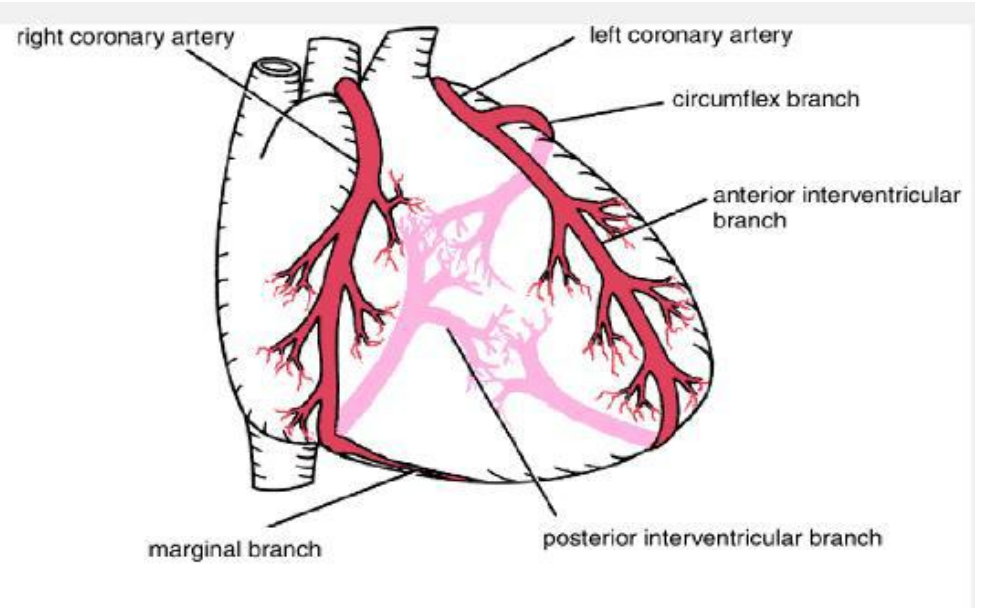
* It is divided into 4 parts: ascending aorta, aortic arch, descending thoracic aorta & abdominal aorta.

1. Ascending Aorta:

* It passes upward to the right within the pericardium.

* It gives the RT & LT coronaries (which supply the heart).





2. Aortic Arch:

* **It lies within the superior mediastinum of the thoracic cavity in front of trachea & esophagus.**
* **It gives 3 branches:**

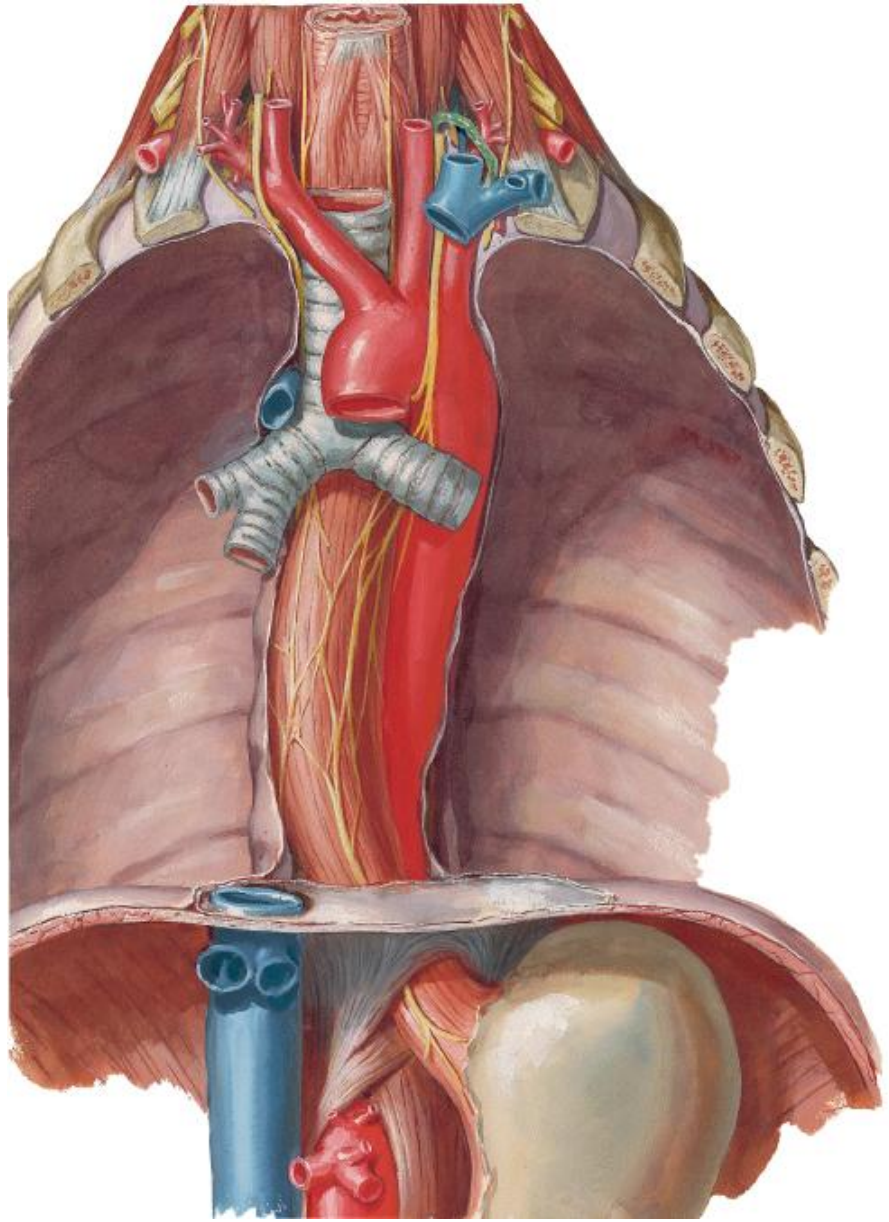
1. Left subclavian A.: which lies in neck & continues in left upper limb as **left axillary artery.**

2. Left common carotid A.: which supplies left half of head & neck.

3. Brachiocephalic (Innominate) A.: which divides into:

a. Right Subclavian A.; which lies in neck & continues in right upper limb as **right axillary A.**

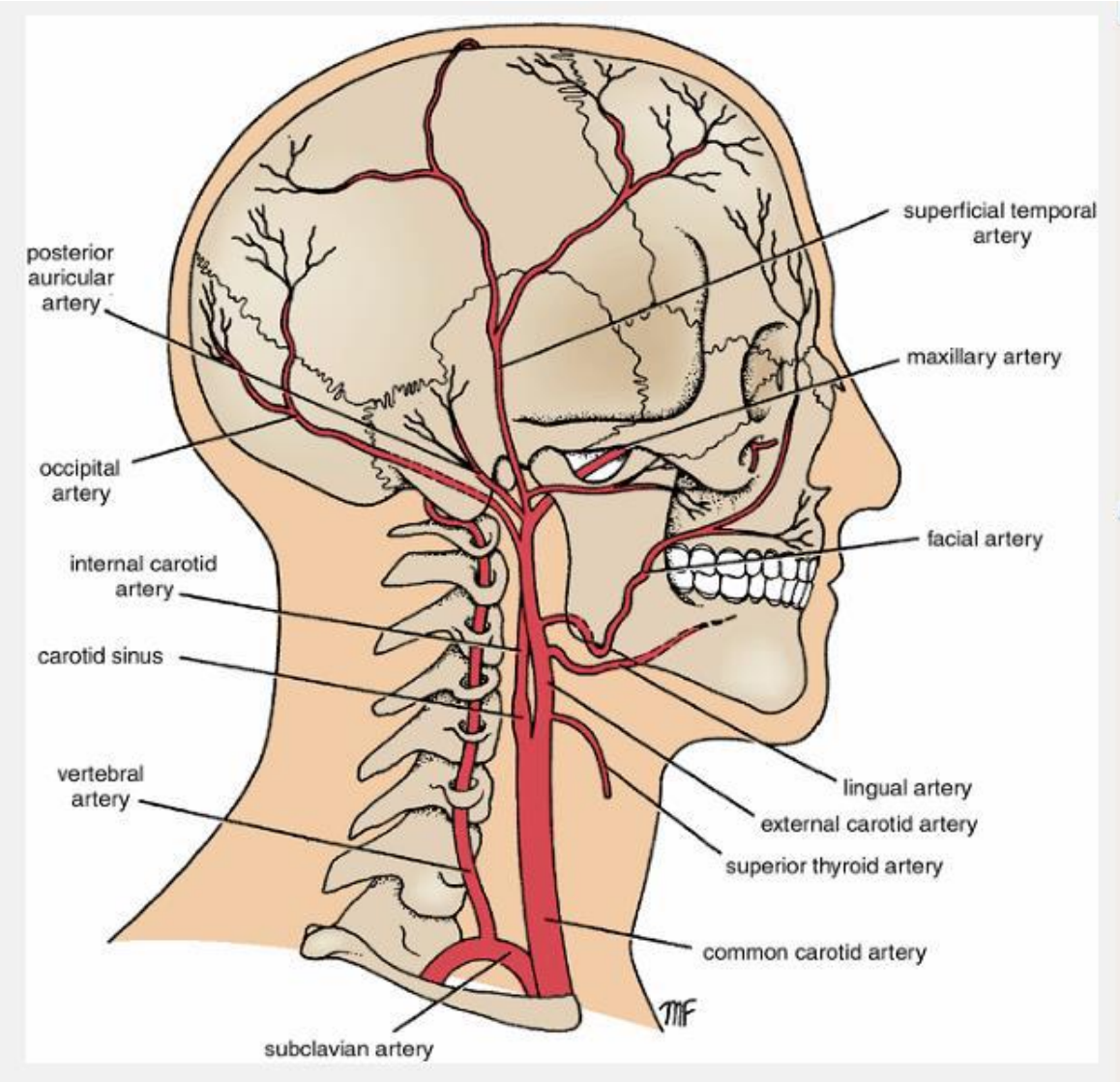
b. Right Common carotid A.; which supplies right half of head & neck.



*** Each common carotid A.** divides into:

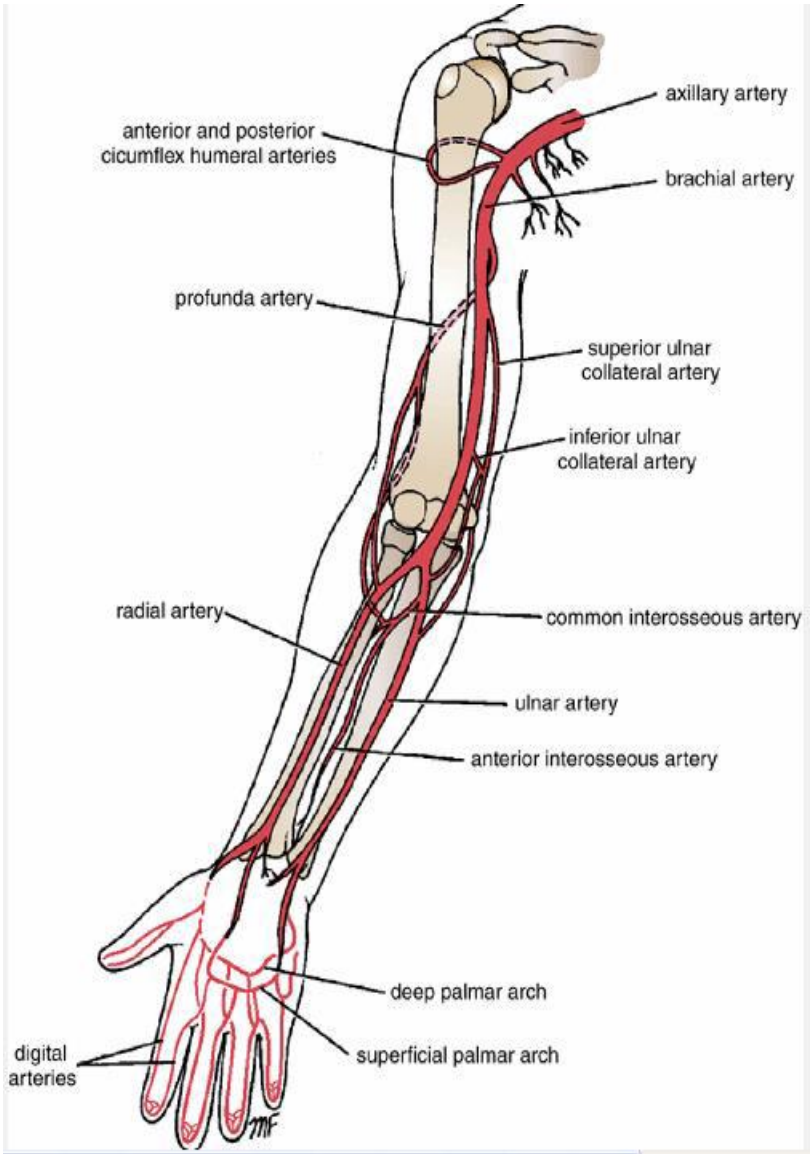
a. External carotid A.; which supplies mainly the structures of head & neck outside the skull.

b. Internal carotid A.; which enters the skull & supplies mainly brain and intracranial structures.



Main arteries of upper limb

* **Subclavian artery: Continues in the upper limb as axillary artery.**
* **Axillary artery: continues as Brachial artery in the arm.**
* **Brachial artery:** descends to the cubital fossa (in front of elbow), where it lies medial to the tendon of biceps muscle. This is an important site, because we put the stethoscope on it when we measure the blood pressure.

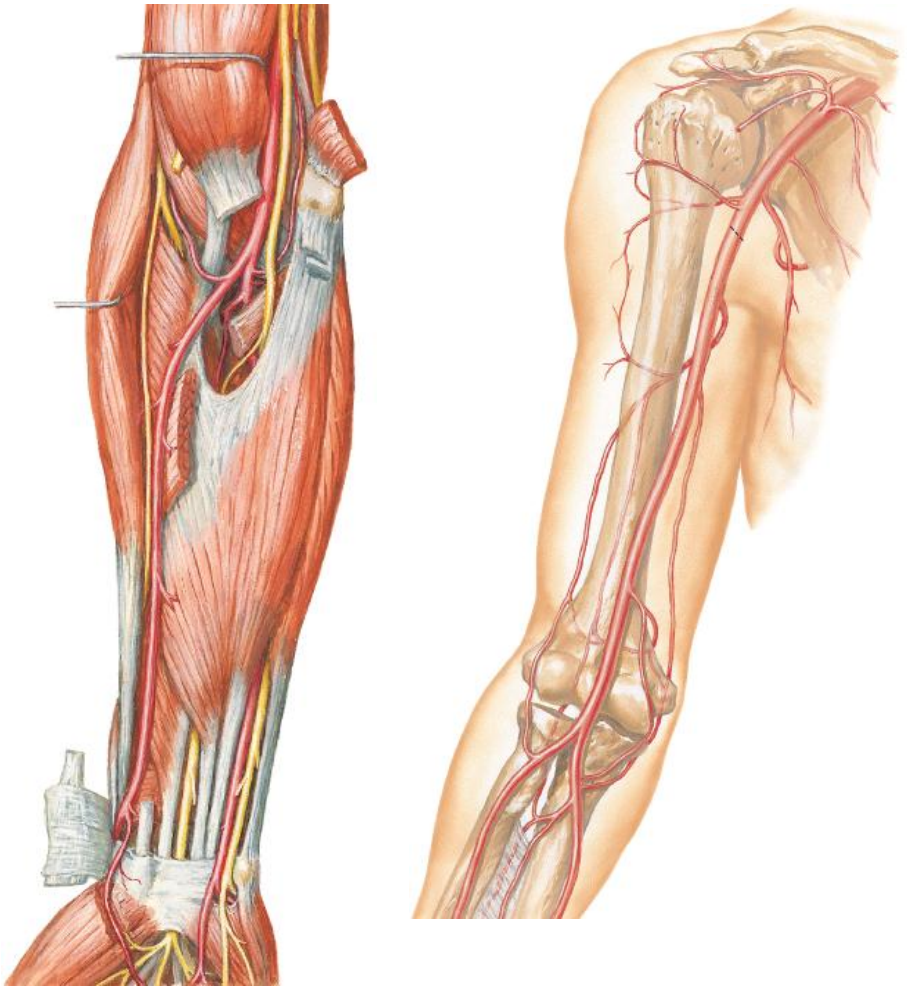


Main arteries of upper limb (contd)

* One cm below bent of elbow, the brachial artery divides into:

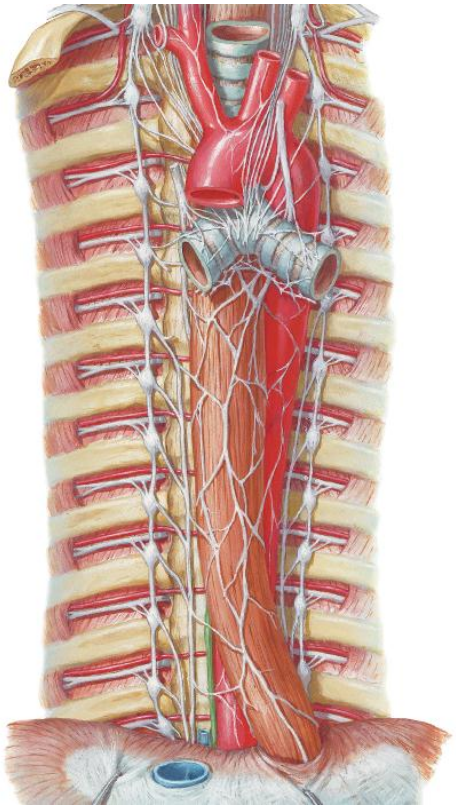
a. Ulnar artery, which runs along the medial side of forearm.

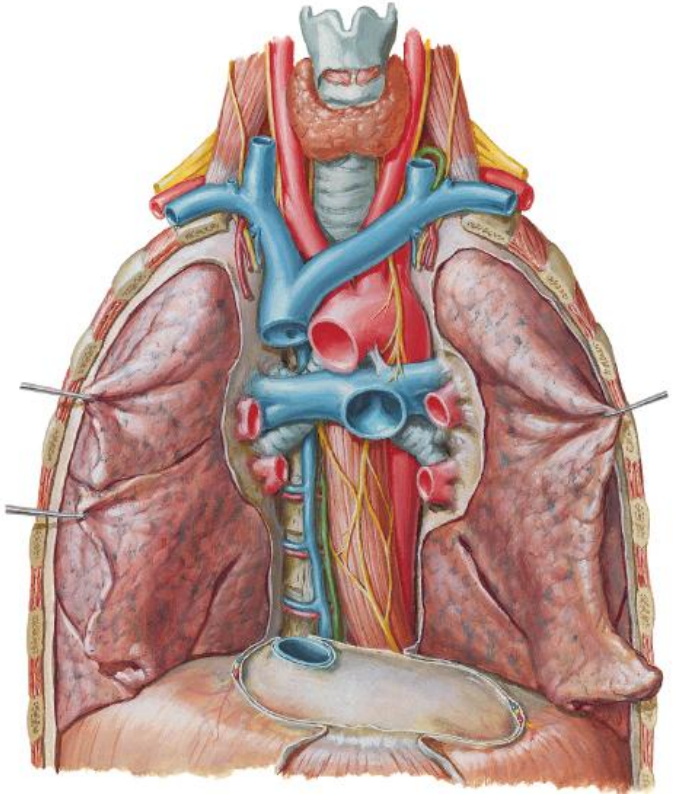
b. Radial artery, which runs along the lateral side of forearm. Above wrist, we can feel the pulse of the radial artery lateral to the tendon of flexor carpi radialis.



3. Descending Thoracic Aorta:

* It lies in the posterior mediastinum.
* It starts at the level of T4 & ends at the level of T12.
* It gives 2 groups of branches:
    a. Parietal group → supplying the thoracic cage: e.g.: Intercostal arteries.
    b. Visceral group → supplying the lungs, trachea & esophagus.





4. Abdominal Aorta:

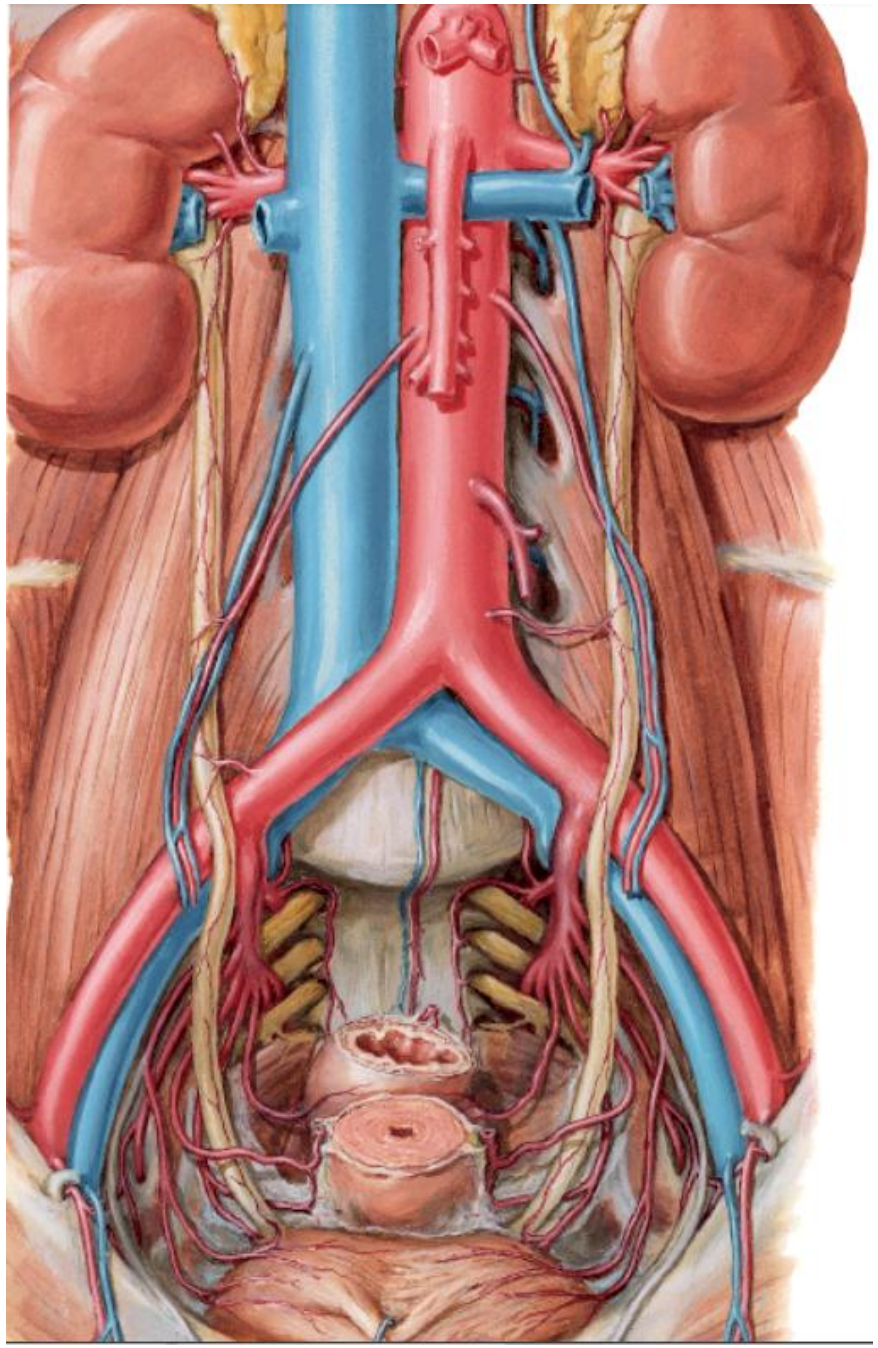
* Lies in front of lumbar vertebrae.
* It starts at T12 & ends at L4.
* It gives 3 groups of branches:

a. **Single branches:** from its anterior aspect for gastrointestinal tube & its related glands (liver, pancreas & spleen) ; They are:

i. celiac trunk.

ii. Superior mesenteric A.

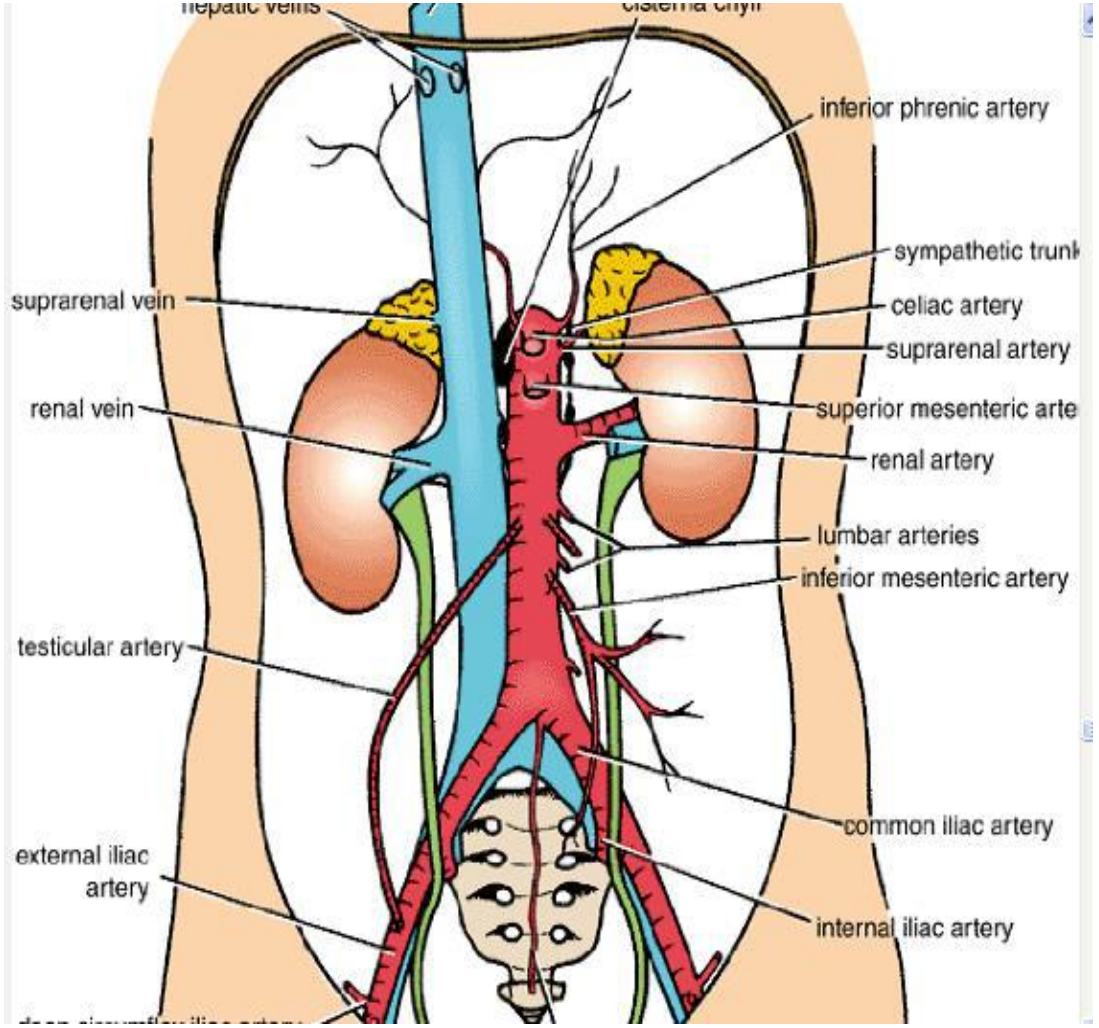
iii. Inferior mesenteric A.



b. Paired branches: from its lateral aspect.

1. Phrenic artery: to diaphragm.
2. Middle suprarenal artery: to suprarenal gland.
3. Renal artery: to kidney.
4. Gonadal artery: testicular artery (to testis) or ovarian artery (to ovary).
5. Four Lumbar arteries: to abdominal wall.

c. Terminal branches: Two common iliac arteries

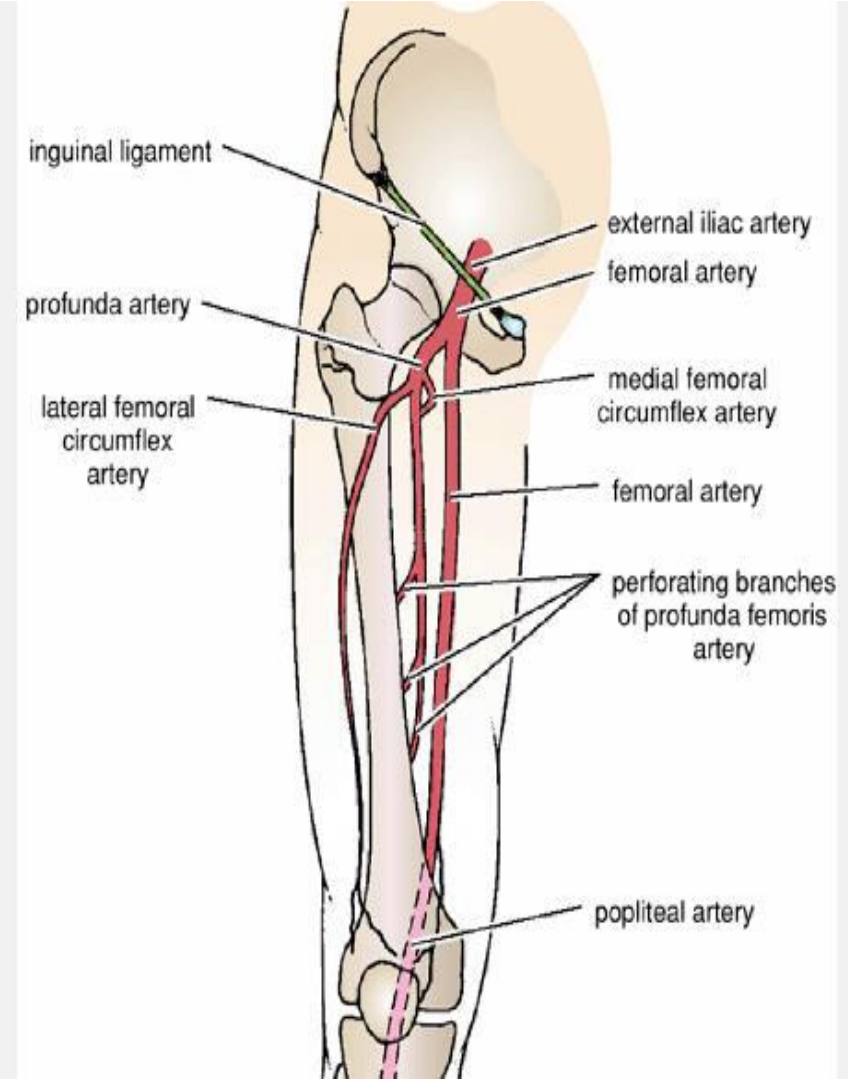


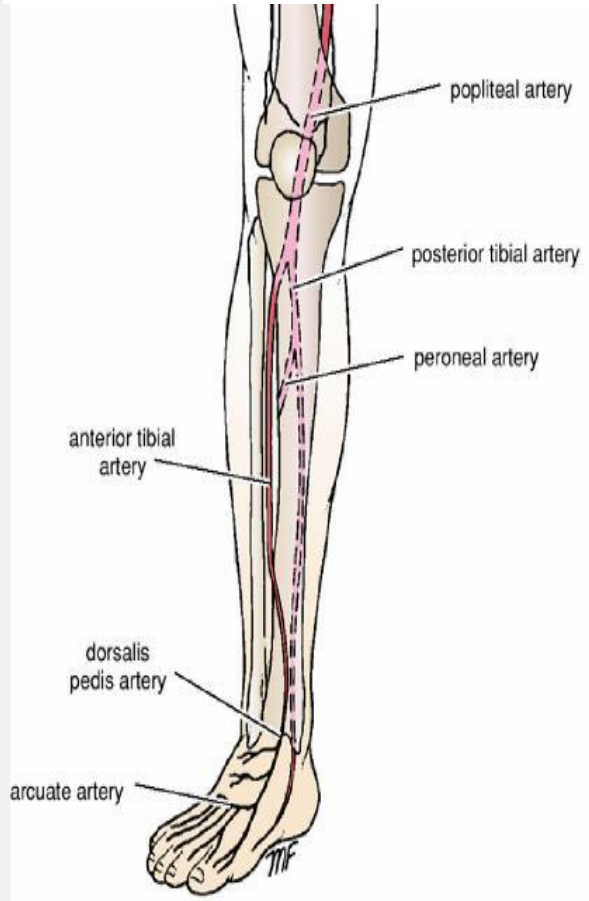
Common Iliac Arteries

*** Each common iliac artery divides into:**

1. Internal iliac artery: which is responsible for blood supply of pelvic organs.

2. External iliac artery: which continues in thigh & forms **femoral artery,** which ends in lower one third of thigh by forming **popliteal A.** which runs in the back of the knee and ends by dividing into: **a. anterior tibial A.;** in front of leg. **b. posterior tibial A**.; in back of leg.

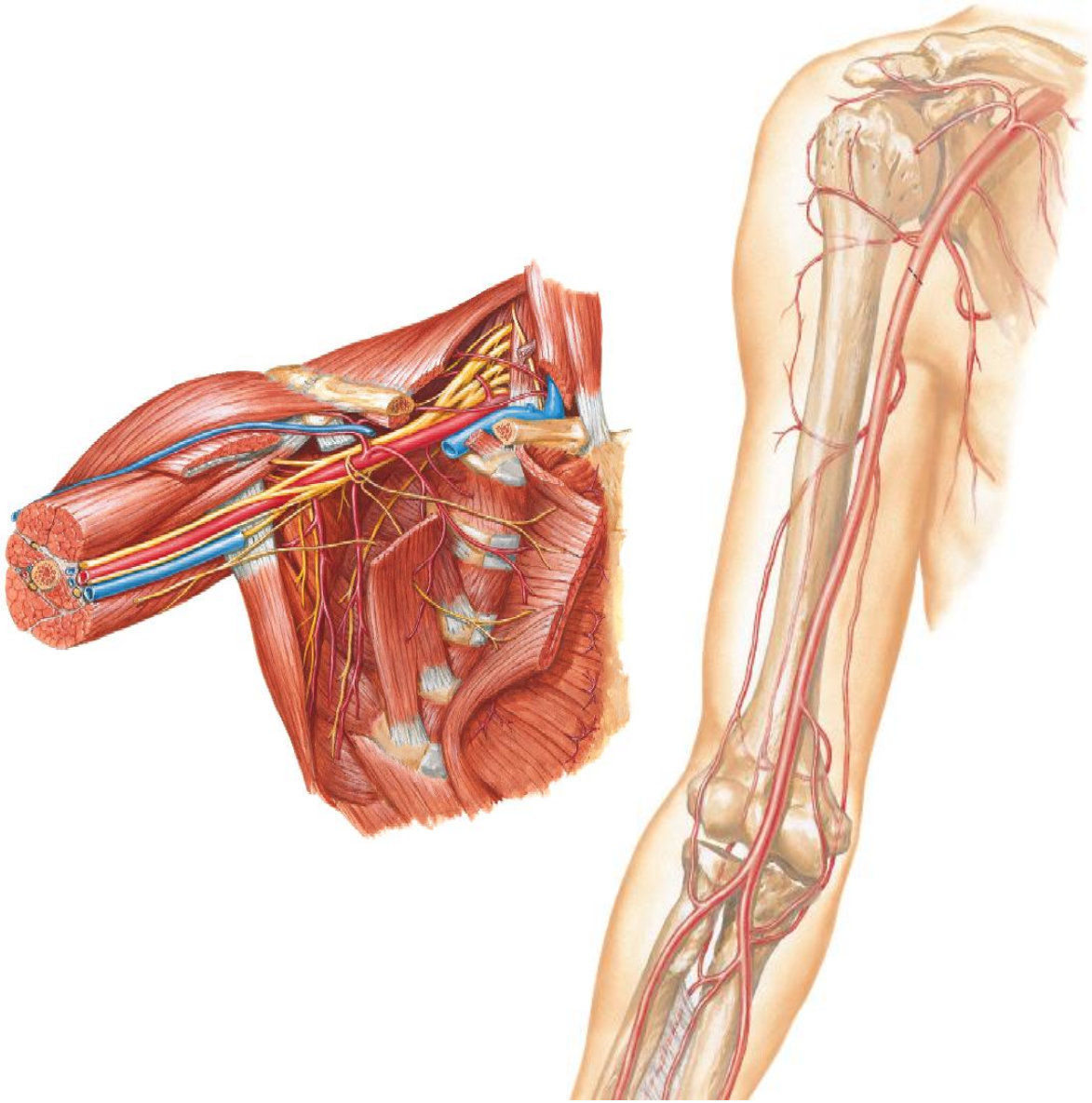




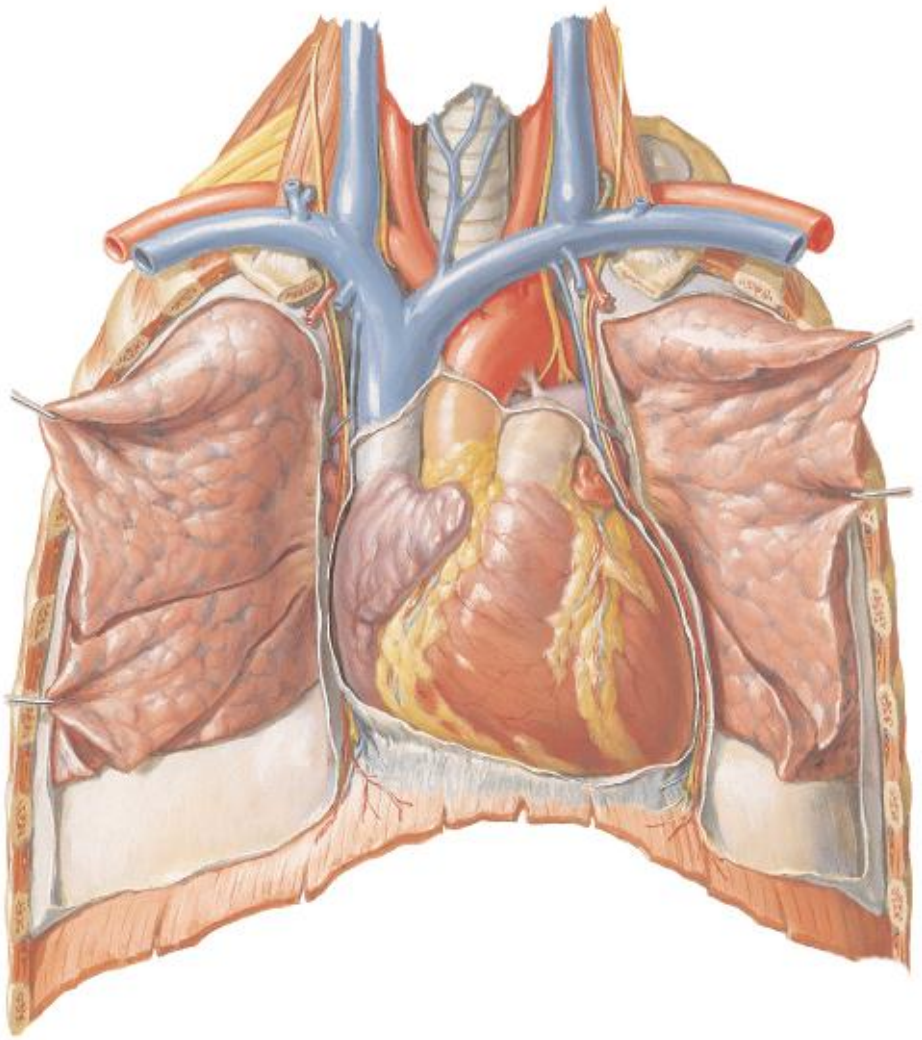
Main Veins of the Body

** **There are 2 types of veins in the body:**

1. **The superficial veins: lie beneath the skin.**
2. **The deep veins: accompany the arteries. Some small arteries are accompanied by two veins called venae comitants.**



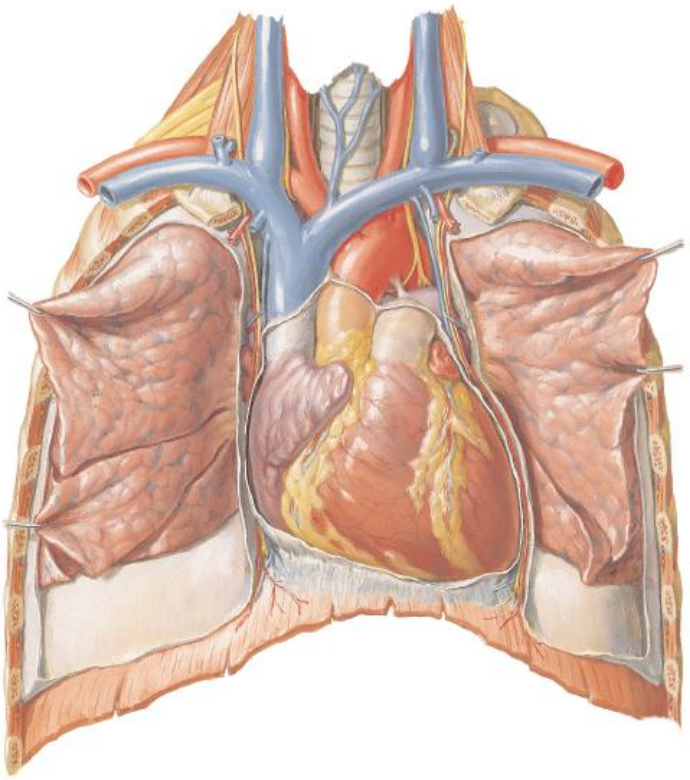
1. Veins of the heart end in the coronary sinus.
2. Veins from the head & neck are collected into internal jugular vein.
3. Veins of the upper limb are collected in the subclavian vein.

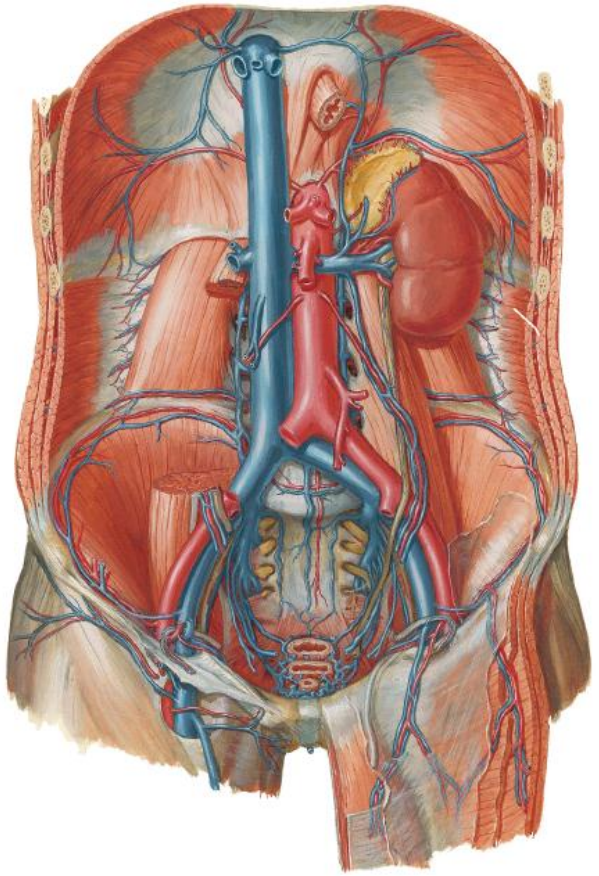


** Internal jugular unites with the subclavian vein to form brachiocephalic vein.

** The 2 brachiocephalic veins unite to form the SVC.

4. Veins of the abdomen, pelvis & lower limbs end in the IVC.

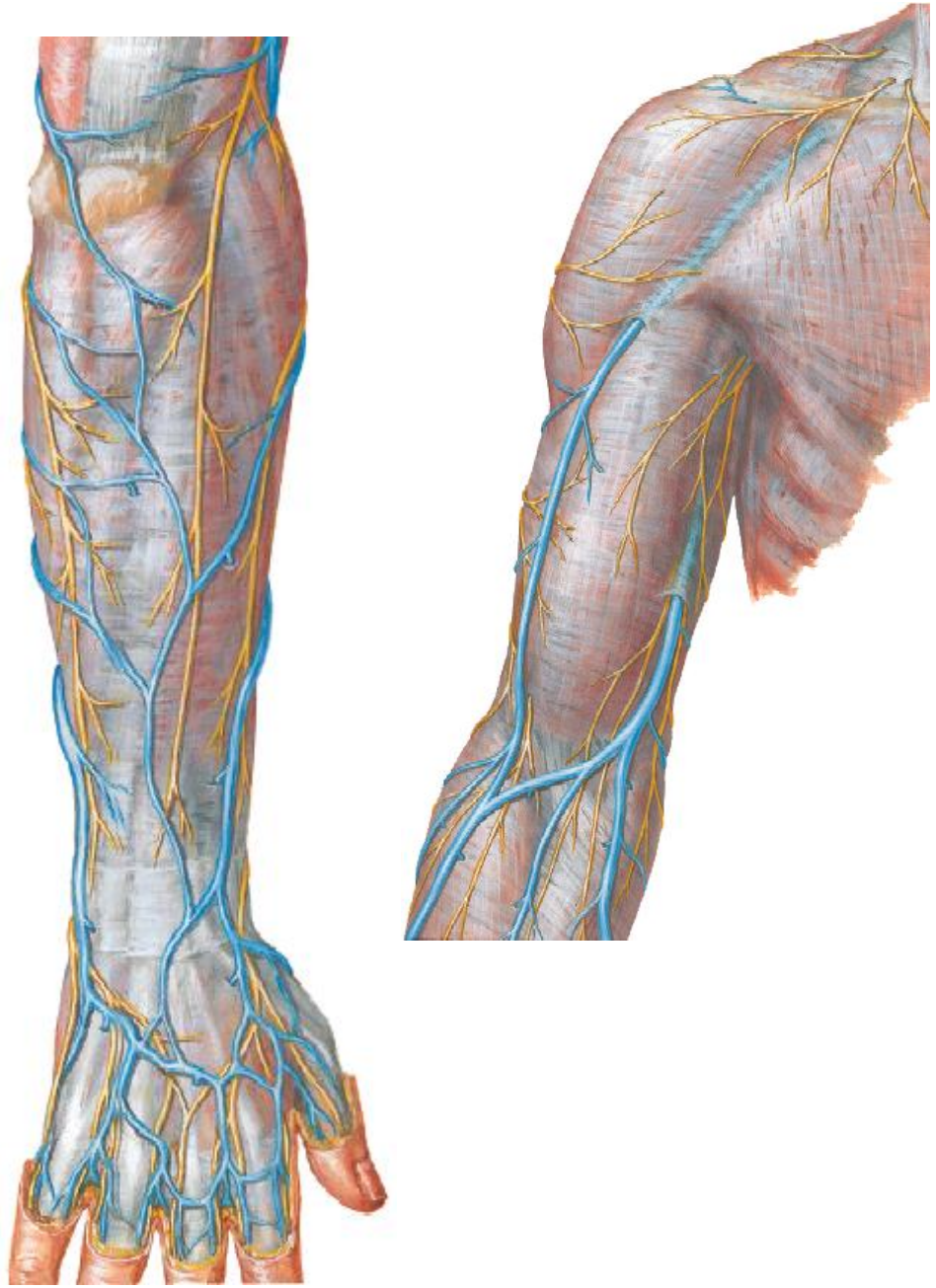




** Superficial veins used in intravenous injection or taking blood sample:

1. **Cephalic vein:** Starts at the lateral end of dorsal venous arch.
2. **Basilic vein:** Starts at the medial end of the dorsal venous arch.

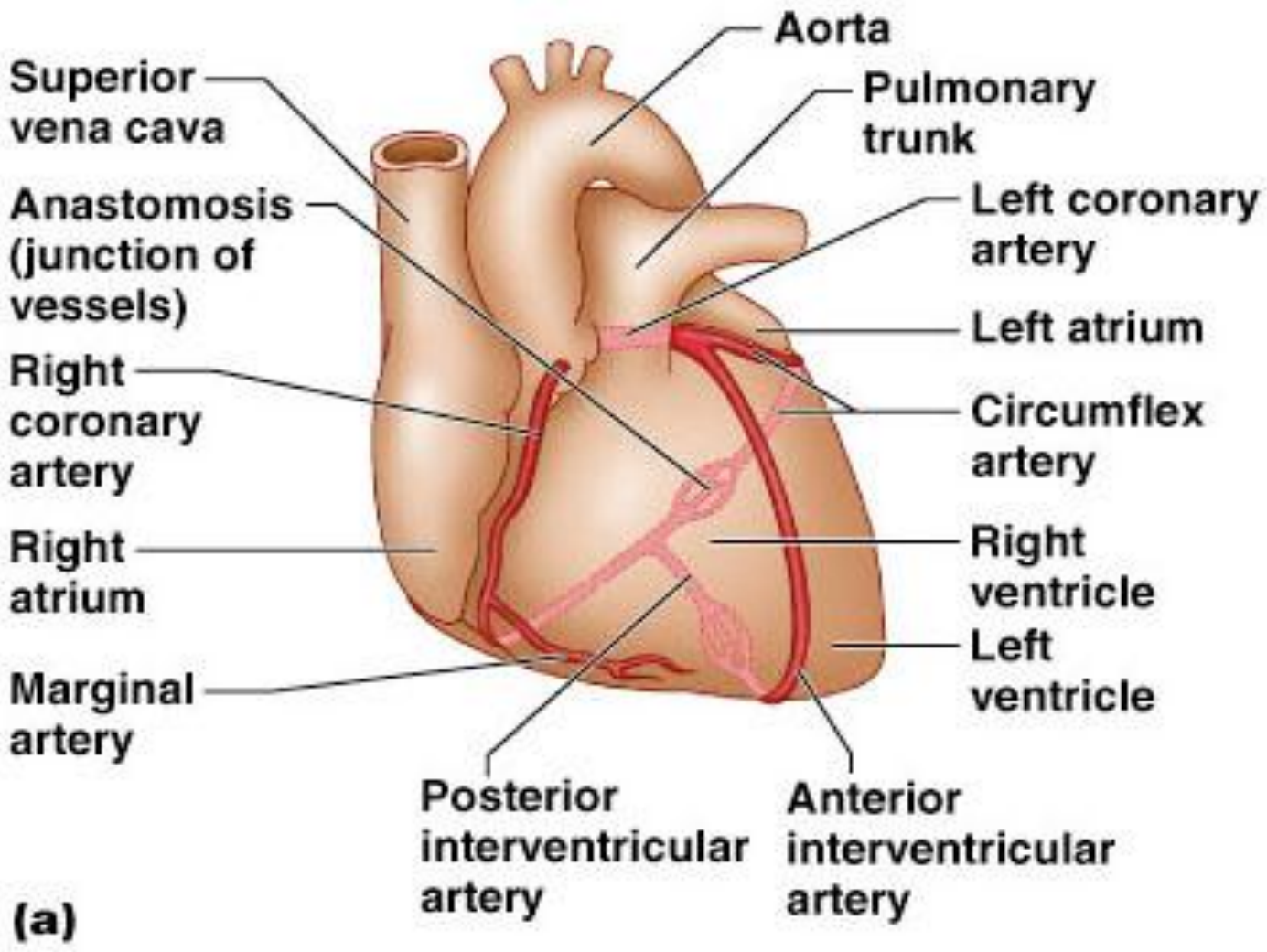
* The cephalic & basilic veins are joined at the elbow by a vein called median cubital vein. This vein is the commonest vein used for intravenous injection.



Types of CIRCULATION

- Coronary circulation – the circulation of blood within the heart.
- Pulmonary circulation – the flow of blood between the heart and lungs.
- Systemic circulation – the flow of blood between the heart and the cells of the body.
- Portal circulation
- Fetal Circulation

CORONARY CIRCULATION: ARTERIAL SUPPLY

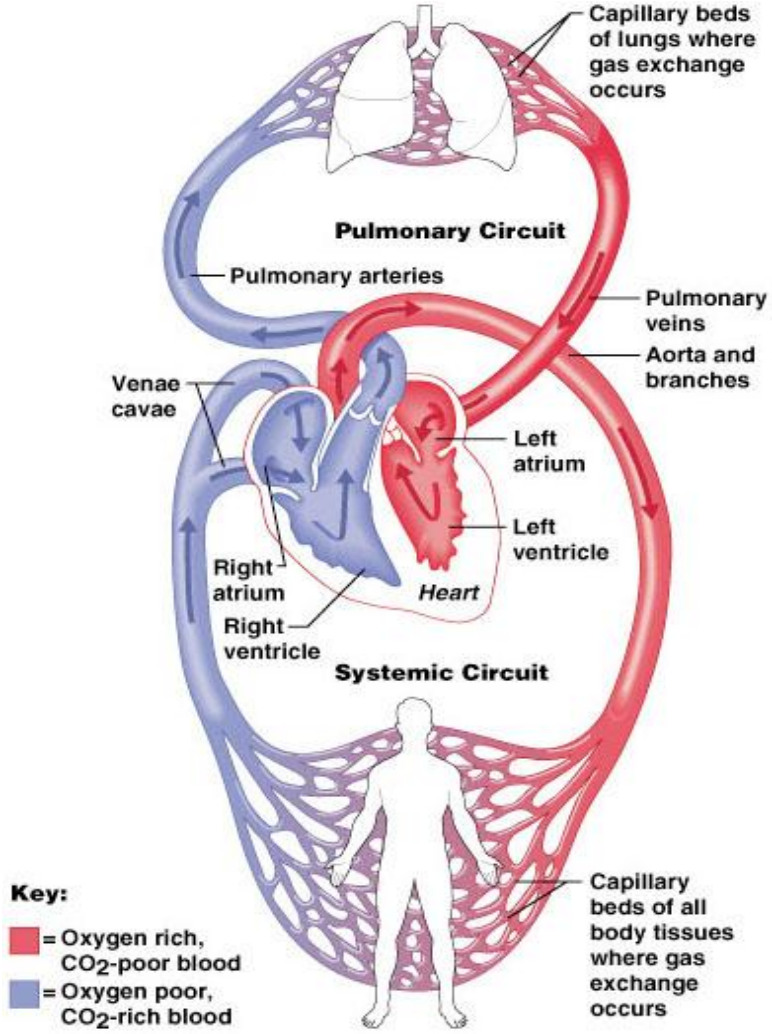


SYSTEMIC AND PULMONARY CIRCULATION

Pulmonary circulation

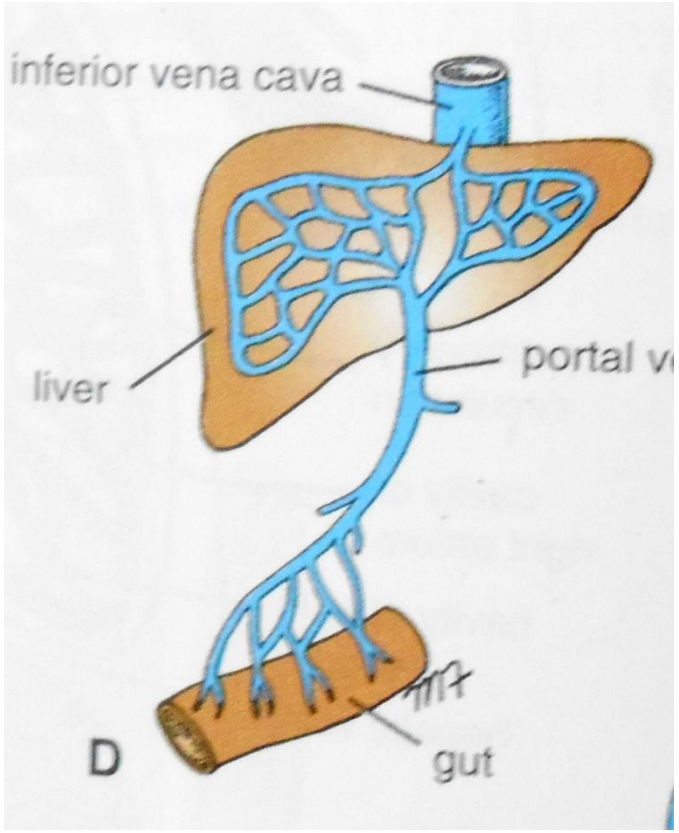
The flow of blood between the heart and lungs.

Systemic circulation **The flow of blood between the heart and the cells of the body.**



PORTAL CIRCULATION

- **Portal circulation - the flow of blood between two set of capillaries before draining in systemic veins.**



FETAL CIRCULATION